Free ebook Application of seismic refraction tomography to karst cavities Copy

basic seismic refraction survey and data interpretation techniques this book is written to impart knowledge on seismic refraction method which covers data acquisition processing and interpretation techniques the discussion in this book is about seismic waves and their characteristics theory of seismic refraction and field procedures examples of seismic refraction data and simple calculation are also provided to enable readers to better visualize and aid their understanding on the seismic refraction method rosli saad is currently a lecturer at school of physics universiti sains malaysia pulau pinang with 30 years of experience in geophysics his expertises is in the areas of ground penetrating radar gpr gravity magnetic seismic and electrical methods his main research is in engineering and environmental studies he has published three research book chapters four research books and more than 250 journal papers recently he was appointed as head of geophysics section at the centre of tropical geoengineering geotropik universiti teknologi malaysia the applicability of the seismic refraction method for engineering purposes was investigated in the thule area of greenland special attention was given to the cases in which shallow ice overlies frozen ground and in which frozen glacial drift up to a few hundred feet thick overlies bedrock seismic velocities were measured in different types of sediments of the thule formation and in the crystalline basement rock the velocities in rock and frozen ground were generally high cementation by ice being the most likely reason at the relatively low ground temperatures of about 10 c it was found that with comparable velocity discrimination the refraction method gives more complete information in permafrost than in unfrozen material since later seismic events can be identified on the records shortly after the first arrival later events also made wide angle reflection soundings possible at a depth as shallow as 200 ft a nagative velocity gradient in the frozen ground is believed to be responsible for the rapid attenuation of tthe direct wave author this volume is a compilation of the newer techniques of refraction seismic surveying it contains a series of articles written principally by members of seg who are specialist in refraction techniques the volume contains only new materials with a bibliography of references to other refraction materials available the majority of the papers are of a technique type which describe some particular interpretation technique that may be used for better interpretation of special refraction data there are many general geophysical textbooks dealing with the subject of seismic refraction as a rule they treat the principles and broad aspects ofthe method comprehensively but problems associated with engineering seismics at shallow depths are treated to a lesser extent the intention of this book is to emphasize some practical and theoretical aspects of detailed refraction surveys for civil engineering projects and water prospecting the book is intended for students of geophysics professional geophysicists and geologists as well as for personnel who without being directly involved in seismic work are planning surveys and evaluating and using seismic results the latter category will probably find chapters 1 5 and 6 of most interest interpretation methods field work and interpretation of field examples constitute the main part of the book when writing i have tried to concentrate on topics not usually described in the literature in fact some discussions on interpretation and correction techniques and on sources of error have not been published previously the field examples which are taken from sites with various geological conditions range from simple to rather complicated interpretation problems thanks are due to a s geoteam norway atlas copco abem ab sweden behaco sweden and the norwegian geotechnical institute for allowing me to use field examples and certain data from their investigations i should particularly like to thank professor dattatray s parasnis of the university of luleii sweden for revising the manuscript and for his numerous invaluable suggestions there are many general

geophysical textbooks dealing with the subject of seismic refraction as a rule they treat the principles and broad aspects ofthe method comprehensively but problems associated with engineering seismics at shallow depths are treated to a lesser extent the intention of this book is to emphasize some practical and theoretical aspects of detailed refraction surveys for civil engineering projects and water prospecting the book is intended for students of geophysics professional geophysicists and geologists as well as for personnel who without being directly involved in seismic work are planning surveys and evaluating and using seismic results the latter category will probably find chapters 1 5 and 6 of most interest interpretation methods field work and interpretation of field examples constitute the main part of the book when writing i have tried to concentrate on topics not usually described in the literature in fact some discussions on interpretation and correction techniques and on sources of error have not been published previously the field examples which are taken from sites with various geological conditions range from simple to rather complicated interpretation problems thanks are due to a s geoteam norway atlas copco abem ab sweden behaco sweden and the norwegian geotechnical institute for allowing me to use field examples and certain data from their investigations i should particularly like to thank professor dattatray s parasnis of the university of luleii sweden for revising the manuscript and for his numerous invaluable suggestions the crustal structure of the baltic shield has been studied based on travel time analysis of p and s wave data recorded from the fennolora deep seismic sounding profile the derived velocity depth models show several low velocity zones in the upper crust along the profile the velocity reduction in these zones is to be less than 7 crust with varying thicknesses of about 13 11 and 19 26 km respectively the velocity gradient is lower in the middle crust compared to that in the upper and lower crust the p velocity increases from about 6 km s at the surface to 6 4 km s in the middle crust in the lower crust velocity varies from about 6 7 km s to 7 3 km s the moho velocity below the crust is to be higher than 8 km s the depth to the moho varies considerably variations on the order of about 10 km as high as 0 28 close to the surface and decreased to below 0 25 at about 2 km depth in the deeper part of the upper crust and in the middle crust o appears to be about 0 24 and increases slightly to about 0 25 in the lower crust at the moho boundary o increases to about 0 26 and decreases to 0 25 beneath the moho this book provides a systematic review of tomographic applications in seismology and the future directions theories and case histories are discussed by the international authors drawing on their own practical experiences with global and local case histories imaging complex regions or difficult terrains like the sub volcanic sediments or thrust fold belt areas is crucial to understanding the earth s subsurface active seismic tomography theory and applications describes current technologies for the study of seismic velocities and the elucidation of fine details of the subsurface key use cases include hydrocarbon reservoir characterization identification of faults and channels and stratigraphic and structural traps volume highlights include theory and development of seismic tomography numerous examples of the interpretation and analysis of active source seismic data relevance of tomography data for computational geophysicists this volume is a valuable resource for academics and professionals interested in using or developing integrated imaging approaches of the earth s subsurface the papers in this volume describe various techniques for separating out special raypath solutions and making approximations that give us a structural geologic picture from the study of these approximations or specializations this reference manual is designed to enable more geophysicists to appreciate static corrections especially their limitations their relationship with near surface geology and their impact on the quality of final interpreted sections the book is addressed to those involved in data acquisition datum static corrections data processing datum static and residual static corrections and interpretation the impact that unresolved static corrections especially the long wavelength or low spatial frequency component have on the interpretation of the final section simple explanations of the underlying principles are included in an attempt to remove some of the mystique of static corrections the principles involved are illustrated with simple models these are supplemented with many data examples this book details

differences in approaches that must be considered among 2d 3d and crooked line recordings as well as between p wave and s wave surveys static corrections are shown to be a simplified yet practical approach to modeling the effects of the near surface where a more correct wavefield or raypath modeled method may not be efficiently undertaken chapters cover near surface topography and geology computation of datum static corrections uphole surveys refraction surveys static corrections limitations and effect on seismic data processes residual static corrections and interpretation aspects an extensive index and a large list of references are included item is a compilation of reports by varying authors each with their own abstracts and bibliographies the reports are all on the topic of laterally heterogenous structures using seismic refraction and reflection data during september 1988 the u s geological survey the geophysics laboratory and the geological survey of canada conducted a seismic refraction experiment across ontario new york and new england this report is a compilation of the geophysics laboratory gl three component refraction and wide angle reflection data recorded during deployments one two and three across the adirondack mountains of upstate new york and the green mountains of vermont and southern new hampshire the appendix includes data collected by boston college and the massachusetts institute of technology which extends the coverage of gl deployment two at both ends of the profile these profiles were designed to constrain the three dimensional velocity structure and bulk composition of the earth s crust and upper mantle across the northern appalachian mountains and western grenville province using three component seismic refraction data of exploration methods commonly used library studies surface geology core drilling aerial mapping magnetomenter surveys gravity surveys seismic reflection exploration seismic refraction exploration wildcat drilling miscellaneous methods summary of seismic methods commonly used seismic dip work continuous profiling the reflection correlation method reflection strike dip surveys refraction surveys reconnaissance surveys detailed surveys routine seismic crew operation cost reduction equipment and personnel overhead geared and ungeared operations functional analysis of geared operations maximum recording efficiency miscellaneous field efficiency considerations office routine danger of losing sight of the purpose of the geared work efficient exploration programs synthesis organization of exploration programs what is exploration information probability of finding oil expected efficiency an analogy the place of seismic prospecting in the overall picture basic technical tools terminology and use of figures pulse fronts rays snells law apparent velocity datum corrections corrections based on short offset geophone locations corrections based on long or medium offset geophone data up hole shooting for weathering velocity calculations based on weathering shots differential weathering correction corrections for point plotting corrections to a deeper datum interrelation of methods preferences structural geologists are well aware of the fact that isotropic rocks are quite exceptional in nature whicheverorigin sedimentary metamorphicormagmatic rocks are shaped with a plane of mineral flattening the foliation in geologists jargon and with a line ofmineral elongation the lineation just like a good quarryman a trained structural geologistwill detectapreferredorientationin an apparently isotropic granite preferred mineral orientation and thus structural anisotropy are the rule in nature consideringthe largevariationsinelasticcoefficientsofrock forming minerals itcould be predicted that in turn seismic anisotropy should exist and be important provided thatdomains withasimilarstructural signatureare largeenough to affectseismic waves this is why in 1982 at a conference held in frankfurt which was oneofthe first meetings devoted to the subject of seismic anisotropy i asked don anderson the question of why seismologists had not considered earlier in their models the obvious constraint of anisotropy i still remember don s answer adolphe we knew that our isotropic models were not very good but we had no other choice it is simply that so far computerswere not largeenough tointegrate the anisotropy parameter changingisotropic glassesfor anisotropic ones permits us to obtain betterand more realistic seismic modelsofthe earth s interior but maybe more importantly it has for a seismologist the farreaching consequenceofsteppinginto the field ofgeodynamics the determination of crustal structure by means of explo sion seismology has been one of the major objectives of the european seismological

commission esc over the past twenty five years it was decided some time ago to publish the results of regional crustal investigations in europe in a series of monographs this publication entitled ex plosion seismology in central europe data and results is volume 1 in a sequence of publications dealing with the crustal structure in europe the european seismologists are indebted to the german geo physical society deutsche geophysikalische gesellschaft for taking the initiative to publish this book thanks are due to the german research society deutsche forschungs gemeinschaft for providing generous financial support of the field measurements and data evaluation it is hoped that this publication will stimulate a continuation of in vestigations of the earth s lithosphere in order to eluci date the details which are still not fully understood seismic measurements take many forms and appear to have a universal role in the earth sciences they are the means for most easily and economically interpreting what lies beneath the visible surface there are huge economic rewards and losses to be made when interpreting the shallow crust or subsurface more or less accurately as the case may be eighteen seismic refraction profiles were shot in the puerto rico trench and outer ridge areas three of these profiles 108 109 and 115 located on the outer ridge were analyzed and corresponding crustal sections were constructed crustal layers obtained from the 3 profiles are in good agreement with those obtained by other workers analyzing intersecting profil s the crust l sectio in the outer ridge appears to be relatively uniform consisting of at least 4 and possibly 5 layers above the mohorovicic discontinuity this discontinuity is found to vary in depth from 11 5 to nearly 13 km along the 3 profiles where the material below the discontinuity exhibited compressional wave velocities of 8 1 to 8 3 km sec author since 1965 seismic reflection profiles have been recorded as part of the seismic refraction and reflection studies conducted by one of the authors on behalf on the ocean seismic research group of japan

Basic Seismic Refraction Survey and Data Interpretation Techniques (Penerbit USM) *1988*

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Application of Seismic-refraction Techniques to Hydrologic Studies *1980*

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The Generalized Reciprocal Method of Seismic Refraction Interpretation *1961*

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The Applicability of Seismic Refraction Soundings in Permafrost Near Thule, Greenland *1972*

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Computer Analysis of Seismic Refraction Data *1967*

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Seismic Refraction Prospecting *2013-03-09*

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Shallow Refraction Seismics *1986*

this book provides a systematic review of tomographic applications in seismology and the future directions theories and case histories are discussed by the international authors drawing on their own practical experiences with global and local case histories

Refraction Seismics *2014-03-14*

imaging complex regions or difficult terrains like the sub volcanic sediments or thrust fold belt areas is crucial to understanding the earth s subsurface active seismic tomography theory and applications describes current technologies for the study of seismic velocities and the elucidation of fine details of the subsurface key use cases include hydrocarbon reservoir characterization identification of faults and channels and stratigraphic and structural traps volume highlights include theory and development of seismic tomography numerous examples of the interpretation and analysis of active source seismic data relevance of tomography data for computational geophysicists this volume is a valuable resource for academics and professionals interested in using or developing integrated imaging approaches of the earth s subsurface

Shallow Refraction Seismics *1992*

the papers in this volume describe various techniques for separating out special raypath solutions and making approximations that give us a structural geologic picture from the study of these approximations or specializations

Analysis and Inversion of Seismic Refraction Traveltimes [microform] *1989*

this reference manual is designed to enable more geophysicists to appreciate static corrections especially their limitations their relationship with near surface geology and their impact on the quality of final interpreted sections the book is addressed to those involved in data acquisition datum static corrections data processing datum static and residual static corrections and interpretation the impact that unresolved static corrections especially the long wavelength or low spatial frequency component have on the interpretation of the final section simple explanations of the underlying principles are included in an attempt to remove some of the mystique of static corrections the principles involved are illustrated with simple models these are supplemented with many data examples this book details differences in approaches that must be considered among 2d 3d and crooked line recordings as well as between p wave and s wave surveys static corrections are shown to be a simplified yet practical approach to modeling the effects of the near surface where a more correct wavefield or raypath modeled method may not be efficiently undertaken chapters cover near surface topography and geology computation of datum static corrections uphole surveys refraction surveys static corrections limitations and effect on seismic data processes residual static corrections and interpretation aspects an extensive index and a large list of references are included

Seismic Refraction Studies in the Baltic Shield Along the Fennolora Profile

1993-05-31

item is a compilation of reports by varying authors each with their own abstracts and bibliographies the reports are all on the topic of laterally heterogenous structures using seismic refraction and reflection data

Seismic Tomography *2023-01-04*

during september 1988 the u s geological survey the geophysics laboratory and the geological survey of canada conducted a seismic refraction experiment across ontario new york and new england this report is a compilation of the geophysics laboratory gl three component refraction and wide angle reflection data recorded during deployments one two and three across the adirondack mountains of upstate new york and the green mountains of vermont and southern new hampshire the appendix includes data collected by boston college and the massachusetts institute of technology which extends the coverage of gl deployment two at both ends of the profile these profiles were designed to constrain the three dimensional velocity structure and bulk composition of the earth s crust and upper mantle across the northern appalachian mountains and western grenville province using three component seismic refraction data

Active Seismic Tomography 1970

of exploration methods commonly used library studies surface geology core drilling aerial mapping magnetomenter surveys gravity surveys seismic reflection exploration seismic refraction exploration wildcat drilling miscellaneous methods summary of seismic methods commonly used seismic dip work continuous profiling the reflection correlation method reflection strike dip surveys refraction surveys reconnaissance surveys detailed surveys routine seismic crew operation cost reduction equipment and personnel overhead geared and ungeared operations functional analysis of geared operations maximum recording efficiency miscellaneous field efficiency considerations office routine danger of losing sight of the purpose of the geared work efficient exploration programs synthesis organization of exploration programs what is exploration information probability of finding oil expected efficiency an analogy the place of seismic prospecting in the overall picture basic technical tools terminology and use of figures pulse fronts rays snells law apparent velocity datum corrections corrections based on short offset geophone locations corrections based on long or medium offset geophone data up hole shooting for weathering velocity calculations based on weathering shots differential weathering correction corrections for point plotting corrections to a deeper datum interrelation of methods preferences

Seismic Refraction Survey at the Una Site, Nevada Test Site, Nye County, Nevada 1990

structural geologists are well aware of the fact that isotropic rocks are quite exceptional in nature whicheverorigin sedimentary metamorphicormagmatic rocks are shaped with a plane of mineral flattening the foliation in geologists jargon and with a line ofmineral elongation the lineation just like a good quarryman a trained structural geologistwill detectapreferredorientationin an apparently isotropic granite preferred mineral orientation and thus structural anisotropy are the rule in nature consideringthe largevariationsinelasticcoefficientsofrock forming minerals itcould be predicted that in turn seismic anisotropy should exist and

be important provided thatdomains withasimilarstructural signatureare largeenough to affectseismic waves this is why in 1982 at a conference held in frankfurt which was oneofthe first meetings devoted to the subject of seismic anisotropy i asked don anderson the question of why seismologists had not considered earlier in their models the obvious constraint of anisotropy i still remember don s answer adolphe we knew that our isotropic models were not very good but we had no other choice it is simply that so far computerswere not largeenough tointegrate the anisotropy parameter changingisotropic glassesfor anisotropic ones permits us to obtain betterand more realistic seismic modelsofthe earth s interior but maybe more importantly it has for a seismologist the farreaching consequenceofsteppinginto the field ofgeodynamics

Data Report for the 1988 Ontario-New York-New England Seismic Refraction Experiment *1967*

the determination of crustal structure by means of explo sion seismology has been one of the major objectives of the european seismological commission esc over the past twenty five years it was decided some time ago to publish the results of regional crustal investigations in europe in a series of monographs this publication entitled ex plosion seismology in central europe data and results is volume 1 in a sequence of publications dealing with the crustal structure in europe the european seismologists are indebted to the german geo physical society deutsche geophysikalische gesellschaft for taking the initiative to publish this book thanks are due to the german research society deutsche forschungs gemeinschaft for providing generous financial support of the field measurements and data evaluation it is hoped that this publication will stimulate a continuation of in vestigations of the earth s lithosphere in order to eluci date the details which are still not fully understood

Seismic Refraction Prospecting 1968

seismic measurements take many forms and appear to have a universal role in the earth sciences they are the means for most easily and economically interpreting what lies beneath the visible surface there are huge economic rewards and losses to be made when interpreting the shallow crust or subsurface more or less accurately as the case may be

Seismic Refraction Studies in Surficial Materials of Victoria Land, Antarctica *1999*

eighteen seismic refraction profiles were shot in the puerto rico trench and outer ridge areas three of these profiles 108 109 and 115 located on the outer ridge were analyzed and corresponding crustal sections were constructed crustal layers obtained from the 3 profiles are in good agreement with those obtained by other workers analyzing intersecting profil s the crust l sectio in the outer ridge appears to be relatively uniform consisting of at least 4 and possibly 5 layers above the mohorovicic discontinuity this discontinuity is found to vary in depth from 11 5 to nearly 13 km along the 3 profiles where the material below the discontinuity exhibited compressional wave velocities of 8 1 to 8 3 km sec author

Static Corrections for Seismic Reflection Surveys *1990*

since 1965 seismic reflection profiles have been recorded as part of the seismic refraction and reflection studies conducted by one of the authors on behalf on the ocean seismic research group of japan

Studies of Laterally Heterogeneous Structures Using Seismic Refraction and Reflection Data *1990*

R035: Seismic refraction studies Tonopah area *1990*

Seismic Refraction Data Processing Software *1983*

Data Report for the 1988 Ontario-New York-New England Seismic Refraction Experiment *1995*

Saudi Arabian Seismic Deep-refraction Profile *1981*

Results of a Shallow Seismic-refraction Survey in the Little Village Area Near Hemet, Riverside County, California *1970*

Seismic Prospecting for Oil 1957

Seismic Refraction Studies of the Subsurface Geology of Walnut Gulch Experimental Watershed, Arizona 1962

A Seismic Refraction Study of the Sub-surface Geology of the Atlantic Coastal Plain and Continental Shelf Between Virginia and Florida *1991-07-31*

Reflection and Refraction of Progressive Seismic Waves *1957*

Seismic Anisotropy in the Earth *1971*

The Construction and Testing of a Shallow Seismic Refraction Instrument for Civil Engineering Purposes *2012-12-06*

Seismic Refraction Survey of Pleistocene Drainage Channels in the Lower Great Miami River Valley, Ohio *1978*

Explosion Seismology in Central Europe *1991**

Seismic Refraction Studies on the Ross Ice Shelf, Antarctica *2006-11-03*

Seismic Refraction Data Interpretation for Engineering and Environmental Investigations *1967*

Rock Quality, Seismic Velocity, Attenuation and Anisotropy *1962*

Seismic Refraction Study of Dixie Valley, Nevada *1977*

Seismic Refraction Profiles on the Outer Ridge North of Puerto Rico *1995*

Seismic Reflection Profiles in the Western Pacific, 1965-1974 *1969*

Browse Basin-North West Kimberley Seismic Refraction Survey, 1993

Shallow Seismic Refraction Studies, Western Lake Superior

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