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A Seismic Study of the Andean and Taiwanese Lithosphere Using Depth-Phase Precursors and S-Wave Receiver Functions Springer Science & Business Media

The scientific achievements of the European Geotraverse Committee (EGT) are presented in this unique study of the tectonic evolution of the continent of Europe and the first comprehensive cross section of the continental lithosphere.

An Interdisciplinary Approach The Rosen Publishing Group, Inc

Physical Geology Univ of California Press

"Physical Geology is a comprehensive introductory text on the physical aspects of geology, including rocks and minerals, plate tectonics, earthquakes, volcanoes, glaciation, groundwater, streams, coasts, mass wasting, climate change, planetary geology and much more. It has a strong emphasis on examples from western Canada, especially British Columbia, and also includes a chapter devoted to the geological history of western Canada. The book is a collaboration of faculty from Earth Science departments at Universities and Colleges across British Columbia and elsewhere"--BCcampus website.

Geological Excursions in the Pacific Northwest **Cambridge University Press**

Revised throughout for enhanced clarity and accuracy - and with a greater emphasis on the process of science - this user-friendly, best-selling laboratory manual examines the basic principles of geology and their applications to everyday life. Students are encouraged to view these principles in terms of natural resources, natural hazards, and human risks. This trusted resource features contributions from highly regarded geologists and geoscience educators, with an exceptional illustration program by Dennis Tasa.

State of the Art for Assessing Earthquake Hazards in the United

States John Wiley & Sons
The lithosphere-asthenosphere boundary (LAB) is a fundamental concept of plate tectonics theory but its origin remains elusive. The lithospheric plate thickness and its relation to crustal age can help better understand the nature of the rheology contrast between the plate and the underlying asthenosphere. This dissertation discusses resolving oceanic lithosphereasthenosphere boundary (LAB) using surface waves. It rst talks about an important step in surface wave tomography - crustal corrections. By studying the eects of using dierent a priori crust models on the nal mantle structure, we nd out that dierences between resulting mantle models is small compared to model uncertainty itself obtained using a model space search method. Secondly, we focus on analyzing dierent seismological proxies for LAB detection, using three dierent datasets and a model space search approach. The resulting statistical distributions of possible models allows us to infer the reliability of the velocity and anisotropy models of the Pacic upper mantle and determine whether the dierences between the proxies are signicant. We found that the LAB depth constrained by surface wave phase velocities is associated with large uncertainties for all proxies. Including surface wave group velocity data aected the radial anisotropy models, but did not satisfactorily reduce the uncertainties on the LAB depth proxies. We nally compared our LAB depth results with theoretical predictions from lithosphere cooling models under dierent conditions. It is shown that a half space cooling model with dehydration eects at the ridge best explains our models, though there remains signicant uncertainties and dependence on the dataset that need to be investigated in future work.

Earth Science Cambridge University Press
Presents an introduction to volcanoes and earthquakes, explaining how the movement of the Earth's interior plates cause their formation and describing the volcanoes which currently exist around the world as well as some of the famous earthquakes of the nineteenth through twenty-first cenuturies.

Physical Geology Prentice Hall
In 1915 Alfred Wegener's seminal work describing the continental drift was first published in German. Wegener explained various phenomena of historical geology, geomorphy, paleontology, paleoclimatology, and similar areas in terms of continental drift. This edition includes new data to support his theories, helping to refute the opponents of his controversial views. 64 illustrations.

Thriving on Our Changing Planet Cambridge University Press
Developments in Geotectonics, 10: The Expanding Earth focuses on the principles, methodologies, transformations, and approaches involved in the expanding earth concept. The book first elaborates on the development of the expanding earth concept, necessity for expansion, and the subduction

myth. Discussions focus on higher velocity under Benioff zone, seismic attenuation, blue schists and paired metamorphic belts, dispersion of polygons, arctic paradox, and kinematic contrast. The manuscript then ponders on the scale of tectonic phenomena, non-uniformitarianism, tectonic profiles, and paleomagnetism. Concerns cover global paleomagnetism, general summary of the tectonic profile, implosions, fluid pressures, pure shear, crustal extension, simple shear with horizontal axis, geological examples of scale fields, and length-time fields of deformation. The publication explores the cause of expansion, modes of crustal extension, and rotation and asymmetry of the earth, including dynamic asymmetry, precessions, nutations, librations, and wobbles at fixed obliquity, variation of rate of rotation, and categories of submarine ridges. The text is a dependable source of data for researchers wanting to study the concept of expanding earth.

The Lithosphere Columbia University Press

Presenting a coherent synthesis of lithosphere studies, this book covers a range of geophysical methods (seismic reflection, refraction, and receiver function methods; elastic and anelastic seismic tomography; electromagnetic and magnetotelluric methods; thermal, gravity and rheological models), complemented by petrologic and laboratory data on rock properties. It also provides a critical discussion of the uncertainties, assumptions, and resolution issues that are inherent in the different methods and models of the lithosphere. Multidisciplinary in scope, global in geographical extent, and covering a wide variety of tectonics settings across 3.5 billion years of Earth history, this book presents a comprehensive overview of lithospheric structure and evolution. It is a core reference for researchers and advanced students in geophysics, geodynamics, tectonics, petrology, and geochemistry, and for petroleum and mining industry professionals.

National Academies Press

An understanding of rocks and the minerals that comprise them lies at the core of every geologist’s education. As more curricula combine mineralogy and petrology into a single course, Raymond and Johnson have responded with a concise introduction to the study of Earth materials. The authors have written at a level that won’t intimidate students encountering fundamental concepts for the first time, yet with enough rigor that they’ll be well prepared for future study. A broad approach to the subject that incorporates fluids and soils will appeal to instructors who teach engineering and environmental science students as well as future geoscientists. Abundant illustrations reinforce all of the ideas in the text. Many images are presented in color, with additional color images available at waveland.com/Raymond-Johnson. Problems appear throughout the book, encouraging a deeper understanding for students. Helpful appendices make it easy

for instructors to assign further exercises in rock and mineral identification as well as optical mineralogy and petrography.

The Continental Drift Controversy NewPath Learning

In the early 1960s, the emergence of the theory of plate tectonics started a revolution in the earth sciences. Since then, scientists have verified and refined this theory, and now have a much better understanding of how our planet has been shaped by plate-tectonic processes. We now know that, directly or indirectly, plate tectonics influences nearly all geologic processes, past and present. Indeed, the notion that the entire Earth's surface is continually shifting has profoundly changed the way we view our world.

The Continental Crust Academic Press

In the Fall of 1988, 64 geologists and geophysicists from 11 countries met in Killarney, Ontario, on the north shore of Lake Huron to examine evidence that suggests that the continental crust is exposed in cross-section at several key locations on the Earth's surface. The meeting, which was held under NATO auspices as an Advanced Study Institute, was a landmark event in that it was the first time that many of the lead scientists working on these complexes in relative isolation around the world had' ever gathered together to compare results. The present volume is a compendium of the invited lectures given on the principle sections, plus an array of supporting papers on these and other sections as well as on related topics such as crustal emplacement mechanisms, deformation and rheology. Nearly all of the best known sections are represented, including the Ivrea Zone, Calabria, the Kapuskasing Zone, Fiordland and many others. It is our hope that this Volume will serve as a reference for Earth scientists who are trying to understand levels of the crust not normally exposed to view, as well as a point of departure for new research and a teaching aid to new entrants in this relatively new field of study.

Heat and Fluid Flux at a Crustal Scale Grosset & Dunlap

The Western U.S. has experienced widespread extension during the past 10's of millions of years, largely within the Basin and Range and Rio Grande Rift provinces. Tomography results from previous studies revealed narrow fast seismic velocity anomalies in the mantle on either side of the Rio Grande Rift as well as at the western edge of the Colorado Plateau. The fast mantle anomalies have been interpreted as down-welling that is part of small scale mantle convection at the edge

of extending provinces. It was also found that crust was thicker than average ab¬¬ove the possible mantle down-welling, indicating that mantle dynamics may influence crustal flow. We present results from P/S conversion receiver functions using SIEDCAR (Seismic Investigation of Edge Driven Convection Associated with the Rio Grande Rift) data to determine crustal and lithospheric structure beneath the east flank of the Rio Grande Rift. Crustal and lithosphere thickness are estimated using P-to-S and S-to-P receiver functions respectively. Receiver function migration methods were applied to produce images of the crust and lithosphere. The results show variable crustal thickness through the region with an average thickness of 45 km. The crust achieves its maximum thickness of 60km at 105W longitude, between 33.5N and 32.2N latitude. This observation confirms previous receiver function results from Wilson et al, 2005. Body wave tomography (Rocket, 2011; Schmandt and Humphreys, 2010) using similar data to what we used for the receiver function analysis, shows mantle downwelling closely associated with the thickened crust. We believe that the thickened crust might be due to lower crustal flow associated with mantle downwelling or mantle delamination at the edge of the Rio Grande Rift. In this model the sinking mantle pulls the crust downward causing a pressure gradient within the crust thus causing the flow. Our S-P images show signal from the lithosphere-asthenosphere boundary (LAB) with an average LAB thickness of 100 km but with a sharp transition at about 1050 W from 75 km to over 100 km. The region with abnormally thick crust overlies a region where the lithosphere appears to have a break. We interpret our results as showing that lower lithosphere has and is delaminating near the edge of the Great Plains accompanied by lower crustal flow in some places determined by lower crustal viscosity.

The European Geotraverse, Structure and Dynamic Evolution National Academies Press

We live on a dynamic Earth shaped by both natural processes and the impacts of humans on their environment. It is in our collective interest to observe and understand our planet, and to predict future behavior to the extent possible, in order to effectively manage resources, successfully

respond to threats from natural and human-induced environmental change, and capitalize on the opportunities â€" social, economic, security, and more â€" that such knowledge can bring. By continuously monitoring and exploring Earth, developing a deep understanding of its evolving behavior, and characterizing the processes that shape and reshape the environment in which we live, we not only advance knowledge and basic discovery about our planet, but we further develop the foundation upon which benefits to society are built. Thriving on Our Changing Planet presents prioritized science, applications, and observations, along with related strategic and programmatic guidance, to support the U.S. civil space Earth observation program over the coming decade.

Volcanic Eruptions and Their Repose, Unrest, Precursors, and Timing National Academies Press
The destructive force of earthquakes has stimulated human inquiry since ancient times, yet the scientific study of earthquakes is a surprisingly recent endeavor. Instrumental recordings of earthquakes were not made until the second half of the 19th century, and the primary mechanism for generating seismic waves was not identified until the beginning of the 20th century. From this recent start, a range of laboratory, field, and theoretical investigations have developed into a vigorous new discipline: the science of earthquakes. As a basic science, it provides a comprehensive understanding of earthquake behavior and related phenomena in the Earth and other terrestrial planets. As an applied science, it provides a knowledge base of great practical value for a global society whose infrastructure is built on the Earth's active crust. This book describes the growth and origins of earthquake science and identifies research and data collection efforts that will strengthen the scientific and social contributions of this exciting new discipline.

Observations and Models of Coupled Transport in Young Oceanic Lithosphere Geological Society of London
Developed by three experts to coincide with geology lab kits, this laboratory manual provides a clear and cohesive introduction to the field of geology. Introductory Geology is designed to ease new students into the often complex topics of physical geology and the study of our planet and its makeup. This text introduces readers to the various uses of the scientific method in geological terms. Readers will encounter a comprehensive yet straightforward style and flow as they journey through this text. They will understand the various spheres of geology and begin to master geological outcomes which derive from a growing knowledge of the tools

and subjects which this text covers in great detail.
A Continent Revealed Physical Geology"Physical Geology is a comprehensive introductory text on the physical aspects of geology, including rocks and minerals, plate tectonics, earthquakes, volcanoes, glaciation, groundwater, streams, coasts, mass wasting, climate change, planetary geology and much more. It has a strong emphasis on examples from western Canada, especially British Columbia, and also includes a chapter devoted to the geological history of western Canada. The book is a collaboration of faculty from Earth Science departments at Universities and Colleges across British Columbia and elsewhere"--BCcampus website.A Teacher's Guide to Questions/answers and Lab Exercises Prepared to Accompany the Film "Inside Hawaiian Volcanoes"The Origin of Continents and Oceans

The elastic properties of fault zone rock at depth play a key role in rupture nucleation, propagation, and the magnitude of fault slip. Materials that lie within major plate boundary fault zones often have very different material properties than standard crustal rock values. In order to understand the mechanics of faulting at plate boundaries, we need to both measure these properties and understand how they govern the behavior of different types of faults. Mature fault zones tend to be identified in large-scale geophysical field studies as zones with low seismic velocity and/or electrical resistivity. These anomalous properties are related to two important mechanisms: (1) mechanical or diagenetic alteration of the rock materials and/or (2) pore fluid pressure and stress effects. However, in remotely-sensed and large-length-scale data it is difficult to determine which of these mechanisms are affecting the measured properties. The objective of this dissertation research is to characterize the seismic velocity and elastic properties of fault zone rocks at a range of scales, with a focus on understanding why the fault zone properties are different from those of the surrounding rock and the potential effects on earthquake rupture and fault slip. To do this I performed ultrasonic velocity experiments under elevated pressure conditions on drill core and outcrops samples from three plate boundary fault zones: the San Andreas Fault, California, USA; the Alpine Fault, South Island, New Zealand; and the Japan Trench megathrust, Japan. Additionally, I compared laboratory measurements to sonic log and large-scale seismic data to examine the scale-dependence of the measured properties. The results of this study provide the most comprehensive characterization of the seismic velocities and elastic properties of fault zone rocks currently available. My work shows that fault zone rocks at mature plate boundary faults tend to be significantly more compliant than surrounding crustal rocks and quantifies that relationship. The results of this study are particularly relevant to the interpretation of field-scale seismic datasets at major fault zones. Additionally, the results of this study provide constraints on

elastic properties used in dynamic rupture models.

The Origin of Continents and Oceans U.S. Government Printing Office

Humans, especially children, are naturally curious. Yet, people often balk at the thought of learning science--the "eyes glazed over" syndrome. Teachers may find teaching science a major challenge in an era when science ranges from the hardly imaginable quark to the distant, blazing quasar. Inquiry and the National Science Education Standards is the book that educators have been waiting for--a practical guide to teaching inquiry and teaching through inquiry, as recommended by the National Science Education Standards. This will be an important resource for educators who must help school boards, parents, and teachers understand "why we can't teach the way we used to." "Inquiry" refers to the diverse ways in which scientists study the natural world and in which students grasp science knowledge and the methods by which that knowledge is produced. This book explains and illustrates how inquiry helps students learn science content, master how to do science, and understand the nature of science. This book explores the dimensions of teaching and learning science as inquiry for K-12 students across a range of science topics. Detailed examples help clarify when teachers should use the inquiry-based approach and how much structure, guidance, and coaching they should provide. The book dispels myths that may have discouraged educators from the inquiry-based approach and illuminates the subtle interplay between concepts, processes, and science as it is experienced in the classroom. Inquiry and the National Science Education Standards shows how to bring the standards to life, with features such as classroom vignettes exploring different kinds of inquiries for elementary, middle, and high school and Frequently Asked Questions for teachers, responding to common concerns such as obtaining teaching supplies. Turning to assessment, the committee discusses why assessment is important, looks at existing schemes and formats, and addresses how to involve students in assessing their own learning achievements. In addition, this book discusses administrative assistance, communication with parents, appropriate teacher evaluation, and other avenues to promoting and supporting this new teaching paradigm.

Living on an Active Earth Academic Press

The crust of the Earth records the deformational processes of the inner Earth and the influence of the overlying atmosphere. The state of the Earth's crust at any time is therefore the result of internal and external processes, which occur on different time and spatial scales. In recent years important steps forward in the understanding of such complex processes have been made by integrating theory and observations with experimental and computer models. This volume presents state-of-the-art analogue and numerical models of processes that alter the Earth's crust. It shows the application of models in a broad range of geological problems with careful documentation of the modelling

approach used. This volume contains contributions on analogue and numerical sandbox models, models of orogenic processes, models of sedimentary basins, models of surface processes and deformation, and models of faults and fluid flow.

Seismic Velocity and Elastic Properties of Plate Boundary Faults Courier Corporation

"This book by Lisa Tauxe and others is a marvelous tool for education and research in Paleomagnetism. Many students in the U.S. and around the world will welcome this publication, which was previously only available via the Internet. Professor Tauxe has performed a service for teaching and research that is utterly unique."—Neil D. Opdyke, University of Florida