On the Nonuniqueness of Receiver Function Inversions
(Charles J. Ammon, George E. Randall, and George Zandt)
15,303

Faulting Mechanism and Complexity of the November 23, 1980, Campania-Lucania Earthquake,
Inferred From Surface Observations
(Daniela Pantosti and Gianluca Valensise)
15,319

Three-Dimensional P and S Velocity Structure in the Coalinga Region, California
(Donna Eberhart-Phillips)
15,343

Earthquakes, Faulting, and Stress in the Los Angeles Basin
(Egill Hauksson)
15,365

Seismic Source Theory in Stratified Anisotropic Media
(Ari Ben-Menahem and Arcangelo G. Sena)
15,395

Depth and Geoid Anomalies Over Oceanic Hotspot Swells: A Global Survey
(Marc Monnereau and Anny Cazenave)
15,429

Microearthquake Evidence for Extension Across the Kane Transform Fault
(William S. D. Wilcock, G. M. Purdy, and Sean C. Solomon)
15,439

Regional Aeolian Dynamics and Sand Mixing in the Gran Desierto: Evidence from Landsat
Thematic Mapper Images
(Grady Blount, Milton O. Smith, John B. Adams, Ronald Greeley, and Phillip R. Christensen)
15,463

The Greenland Gravitational Constant Experiment
(Mark A. Zumberge, Mark E. Ander, Ted V. Lautzenhisser, Robert L. Parker, Carlos L. V. Aiken, Michael R. Gorman, Michael Martin Nieto, A. Paul R. Cooper, John F. Ferguson, Elizabeth Fisher, James Greer, Phil Hammer, B. Lyle Hansen, George A. McMechan, Glenn S. Sasagawa, Cyndi Sidles, J. Mark Stevenson, and Jim Wirtz)
15,483

Fast Instantaneous Oceanic Plate Velocities Recorded by the Cretaceous Laytonville Limestone:
Paleomagnetic Analysis and Kinematic Implications
(John A. Tarduno, Michael McWilliams, and Norman Sleep)
15,503

The Structure of 0- to 0.2-m.y.-Old Oceanic Crust at 9°N on the East Pacific Rise From Expanded
Spread Profiles
15,529

Sensitivity of the Telluric Monitoring Array in Parkfield, California, to Changes of Resistivity
(Stephen K. Park and David V. Fitterman)
15,557

Field-Impressed Anisotropies of Magnetic Susceptibility and Remanence in Minerals
(David K. Potter and Alan Stephenson)
15,573

Amorphous Material in High Strain Experimental Fault Gouges
(R. A. Yund, M. L. Blanpied, T. E. Tullis, and J. D. Weeks)
15,589

Calibration of a Belt Apparatus to 1800°C and 6 GPa
(G. P. Brey, R. Weber, and K. G. Nickel)
15,603

Modeling the Consolidation of a Porous Aggregate of Dry Salt as Isostatic Hot Pressing
(David J. Holcomb and David H. Zeuch)
15,611

Decrepitation and Crack Healing of Fluid Inclusions in San Carlos Olivine
(B. J. Wanamaker, Teng-fong Wong, and Brian Evans)
15,623

(continued on inside back cover)
Permeability Estimation From Velocity Anisotropy in Fractured Rock  
Richard L. Gibson, Jr. and M. Nafi Toksöz 15,643

Correction to “Volcanic Geology of Tyrrrhena Patera, Mars”  
Ronald Greeley and David A. Crown 15,657

Editor’s Note  
Robert C. Liebermann 15,659

Special Section: Silicate Melts and Mantle Petrogenesis (in Memory of Christopher M. Scarfe)

Memorial to Christopher Martin Scarfe  
Donald B. Dingwell 15,661

Introduction to C. M. Scarfe Memorial: Special Section on Silicate Melts and Mantle Petrogenesis  
Donald B. Dingwell 15,663

Chemical Diffusion of Ferrous Iron in a Peraluminous Sodium Aluminosilicate Melt: 0.1 MPa to 2.0 GPa  
Todd Dunn and William A. Ratliffe 15,665

Physical Properties and Structure of $K_2Si_4O_9$ Melt Quenched From Pressures up to 2.4 GPa  
James E. Dickinson, Jr., Christopher M. Scarfe, and Paul McMillan 15,675

The Effect of $H_2O$ and $CO_2$ on the Viscosity of Sanidine Liquid at High Pressures  
Bradford S. White and Art Montana 15,683

Non-Newtonian Rheology of Igneous Melts at High Stresses and Strain Rates: Experimental Results for Rhyolite, Andesite, Basalt, and Nephelinite  
Sharon L. Webb and Donald B. Dingwell 15,695

Ferric Iron in Silicate Melts in the System $Na_2O$-$Fe_2O_3$-$SiO_2$ at High Pressure  
Mark Brearly 15,703

Lanthanides in Silicate Glasses: A Vibrational Spectroscopic Study  
Adam J. G. Ellison and Paul C. Hess 15,717

Local Structure in Gallium- and Germanium-Substituted Silicate Glasses Investigated by Magic Angle Spinning Nuclear Magnetic Resonance  
Barbara L. Sherriff and Michael E. Fleet 15,727

Effect of Pressure, Temperature, and Bulk Composition on the Structure and Species Distribution in Depolymerized Alkali Aluminosilicate Melts and Quenched Melts  
Bjorn O. Mysen 15,733

Melt Structure in the System Nepheline-Diopside  
Dan Sykes and Christopher M. Scarfe 15,745

Phase Relations in the Transition Zone  
Tibor Gasparik 15,751

Melting of Enstatite ($MgSiO_3$) From 10 to 16.5 GPa and the Forsterite ($Mg_2SiO_4$) - Majorite ($MgSiO_3$) Eutectic at 16.5 GPa: Implications for the Origin of the Mantle  
D. C. Presnall and T. Gasparik 15,771

Origin of Mantle Peridotite: Constraints From Melting Experiments to 16.5 GPa  
Claude Herzberg, Tibor Gasparik, and Hiroshi Sawamoto 15,779

Phase Relations in Peridotite + $CO_2$ Systems to 12 GPa: Implications for the Origin of Kimberlite and Carbonate Stability in the Earth’s Upper Mantle  
Dante Canil and Christopher M. Scarfe 15,805

Phase Relations of Aluminum-Undepleted and Aluminum-Depleted Komatiites at Pressures of 4-12 GPa  
Kejian Wei, Reidar G. Trønnes, and Christopher M. Scarfe 15,817

An in Situ X Ray Diffraction Study of the Kinetics of the Ni$_2$SiO$_4$ Olivine-Spinel Transformation  
D. C. Rubie, Y. Tsuchida, T. Yagi, W. Utsumi, T. Kikegawa, O. Shimomura, and A. J. Brearley 15,829

An Experimental Test of the Spinel Peridotite Oxygen Barometer  
Bernard J. Wood 15,845
Introduction to C. M. Scarfe Memorial: Special Section on Silicate Melts and Mantle Petrogenesis

DONALD B. DINGWELL

Bayerisches Geoinstitut, Universität Bayreuth, Bayreuth, Federal Republic of Germany

In the summer of 1988 it was decided to commemorate Chris's career with a special session at an international meeting and a publication containing contributions volunteered by his former friends and associates. The 1989 Spring Meeting of the American Geophysical Union was chosen for the memorial session and the Journal of Geophysical Research was chosen for the publication of contributed scientific papers. This section would not have been possible without the active encouragement, advice, and direction provided by Bob Liebermann. I also extend my thanks to the participants and to the reviewers.

Silicate melts have played a crucial role in the differentiation of the Earth via igneous processes. Thus the study of such melts is as fundamental as mineralogy to the earth sciences. The physical properties of silicate melts provide valuable information for modeling the behavior of silicate magmas during igneous petrogenesis. Transport properties, such as diffusivities and viscosity, are especially important in igneous petrogenesis because of the possibility of kinetic control of many igneous processes at depth within the Earth. In this section, physical properties of silicate melts are investigated in papers by White and Montana; Dickinson, Scarfe, and McMillan; Dunn and Ratliffe; and Webb and Dingwell. White and Montana have determined the effects of H_2O and CO_2 on the viscosity of KAlSi_3O_8 liquid at high pressure and temperature. Dickinson, Scarfe, and McMillan have determined the liquid viscosities and quench glass densities of K_2Si_3O_8 subjected to pressures up to 2.4 GPa. Raman spectra on the same glasses are used to infer the effects of pressure on melt speciation. Dunn and Ratliffe have investigated chemical diffusion of ferrous iron in a peraluminous sodium aluminosilicate melt at high temperature and pressures to 1.0 GPa. Webb and Dingwell have investigated the onset of non-Newtonian rheological behavior in geological melts.

A comprehensive understanding of silicate melt properties can only come from a model for the structure of such liquids and glasses. For some time, such a consideration has prompted the investigation of short range order in silicate melt within the geological community. A large number of spectroscopic methods continue to be employed in the characterization of the coordination of the large number of chemical components present in natural melts and their analog systems. In this section, Brearley; Ellison and Hess; Sherriff and Fleet; Mysen; and Sykes and Scarfe investigate melt structure by spectroscopy. Brearley has performed a ^57Fe Mössbauer investigation of the effect of pressure on the coordination state of ferric iron in highly oxidized melts of the Na-Fe-Si-O system. Ellison and Hess have obtained perpendicular and parallel-polarized Raman spectra on lanthanide-bearing silicate glasses. Sherriff and Fleet present ^29Si, ^27Al, and ^23Na MAS NMR spectra for gallium and germanium-substituted silicate glasses. Mysen has studied the Raman spectra of peralkaline alkali aluminosilicate glasses. Sykes and Scarfe present a Raman spectra form glasses on the NaAlSiO_4-CaMgSi_2O_6 join. The development of multianvil techniques for the generation of high pressures acting on large volumes has opened a new chapter in the experimental investigation of geological materials. Papers by Gasparik; Presnall and Gasparik; Herzberg, Gasparik, and Sawamoto; Canil and Scarfe; Wei, Trönnes, and Scarfe; Pacalo and Gasparik; and Rubie, Tsuchida, Yagi, Utsumi, Kikegawa, Shimomura, and Brearley illustrate the growing body of high-pressure phase equilibrium and kinetic data on silicate systems. The most immediate impact of such studies is constraints on the petrogenesis of the Earth's mantle. Gasparik has investigated phase relations in the MgO-Al_2O_3-SiO_2 and CaO-Al_2O_3-SiO_2 systems at temperatures up to 2500°C and pressures to 22.6 GPa. Presnall and Gasparik have determined the melting curve of enstatite from 10 to 16.5 GPa and the forsterite-majorite eutectic at 16.5 GPa. Herzberg, Gasparik, and Sawamoto have investigated the melting of komatiite, peridotite, and chondrite systems at temperatures up to 2500°C and pressures up to 25 GPa. Canil and Scarfe report phase relations in the peridotite-CO_2 system to 12 GPa. Wei, Trönnes, and Scarfe have investigated the phase relations of aluminum depleted and undepleted komatiites between 4 and 12 GPa.

Rubie, Tsuchida, Yagi, Utsumi, Kikegawa, Shimomura, and Brearley have performed an in situ X ray diffraction study of the kinetics of the Ni_2SiO_4 olivine-spinel transformation. Pacalo and Gasparik have reversed the orthoenstatite-clinoenstatite transition at 7–11 GPa.

The oxidation state of the upper mantle is currently the subject of much discussion. In this section, Wood has experimentally tested a spinel peridotite oxygen barometer based on the Fe_2O_4 content of spinel coexisting with olivine and orthopyroxene. Ultramafic nodules are the most direct source of petrological, isotopic and geochemical on the upper mantle. In this section, Liang and Elthon present a major and trace element characterization of spinel lherzolite xenoliths from Xalapasco de La Joya, San Lius Potosi, Mexico. Xue, Baadsgaard, Irving, and Scarfe have obtained major, trace, and whole rock Sr and Nd isotopic data for spinel peridotite xenoliths from West Kettle River, British Columbia.

Volcanological studies provide tests of petrogenetic hypotheses and raise questions for further experimental investigations. In this section, Trönnes presents a geological,
petrographic and geochemical synthesis of basalts from the Hengill Volcanic System of SW Iceland. Gunter, Hoinkes, Ogden, and Pajari describe and interpret centimeter-scale intraflow layering of orendite and wyomingite from the Leucite Hills, Wyoming.

Ultimately, the goal of experiments and observations on rocks and synthetic analogs is a synthesis of the petrological, geochemical and geophysical constraints on geologic processes. Two syntheses, by Kushiro on island arc petrogenesis and by Takahashi on Archaean mid-ocean ridges, complete this memorial section. Kushiro presents the results of "sandwich" experiments bearing on the melts produced during partial melting of a hydrous peridotite at pressures of 1.2–2.0 GPa. These results are combined with seismic velocity and crustal xenolith data to yield a synthesis for the evolution of the crust in the NE Honshu arc. Takahashi uses high-pressure peridotite melting data and the geochemistry of depleted garnet peridotites and peridotitic komatiites to generate a speculative model for the nature of mid-oceanic ridges in the Archaean.

D. B. Dingwell, Bayerisches Geoinstitut, Universität Bayreuth, Postfach 10 12 51, 8580 Bayreuth, West Germany.

(Received March 12, 1990; accepted April 9, 1990.)