SHUN-ICHIRO KARATO

Professor
Born: 4 September 1949, Fukuoka Japan
Japanese citizen, permanent resident in U.S.A.

## Education

University of Tokyo 1968-77
B.Sc., Geophysics, 1972
M.Sc., Geophysics, 1974
Ph.D., Geophysics, 1977

## Positions

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|---|---|
| 1977-1989 | Assistant Professor, Ocean Research Institute, University of Tokyo |
| 1981-1985 | Research Fellow, Research School of Earth Sciences, The Australian National University |
| 1988 | Visiting Scientist, University of Colorado |
| 1988 | Visiting Scientist, CSIRO, Melbourne |
| 1988 | Visiting Fellow, The Australian National University |
| 1988-1989 | Visiting Lecturer, Kyoto University |
| 1989-1992 | Associate Professor, University of Minnesota |
| 1992-2001 | Professor, University of Minnesota |
| 2001- | Professor, Yale University |
| 2006- | Visiting Professor, Tohoku University |
| 2008- | Adolph Knopf Professor, Yale University |
| 2013- | Visiting Professor, Shizuoka University |

## Awards, Honors

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|---|---|
| Yoshida Foundation Fellow | 1987 |
| Japan Society of Promotion of Science Fellow | 1988 |
| Alexander von Humboldt Prize | 1995 |
| Editor's Citation for Excellence in Refereeing for *Geophysical Research Letters* | 1998 |
| Vening Meinesz lecture (Utrecht University) | 1998 |
| Japan Academy Prize | 1999 |
| Fellow of American Geophysical Union | 2000 |
| Kozu lecture (Tohoku University) | 2003 |
| Birch lecture (AGU) | 2004 |
| Vening Meinesz medal (VMSG) | 2006 |
| Arduino lecture (University of Padua) | 2010 |
| Fellow of Mineralogical Society of America | 2011 |
| Science Lectureship Award (Chiba University) | 2012 |
| Allday lecture (UT Austin) | 2013 |
| Augustus Love medal (EGU) | 2014 |
| Fellow of Japan Geoscience Union | 2014 |
| 40 most influential papers published in GRL | 2014 |

Umbgrove lecture (Utrecht) 2015
Inge Lehmann medal (AGU) 2016

Invited lectures (2000-)

at GEOSCIENCE 2000, Manchester (UK), 2000
at MARGINS workshop on Subduction Factory, Eugene (Oregon), 2000
at Ocean Hemisphere Project workshop, Yamanashi (Japan), 2001
at Deformation, Rheology and Tectonics, (the Netherlands), 2001
at Gordon conference on "Composition, Structure, and Dynamics of the Earth's Interior", New Hampshire, 2001
at Goldschmidt conference, Virginia, 2001
at Superplume workshop, Tokyo (Japan), 2002
at SEDI meeting, Lake Tahoe, 2002
at CIDER workshop, California, 2003
at The Deep Earth, Acquafredda di Maratea (Italy), 2003
at the Goldschmidt conference, Copenhagen (Denmark), 2003
at Gordon Conference on “Rock Deformation”, 2004
at the COE workshop, Misasa (Japan), 2005
at the workshop on “DAC and radial X-ray diffraction”, APS, 2005
at the workshop on “Post-perovskite”, TIT (Tokyo), 2005
at MARGINS workshop (WHOI), 2006
at MSA workshop (Italy), 2006
at PGP workshop, Oslo (Norway), 2007
at ISRS-16 workshop, Minneapolis, 2007
at VLab-7 workshop, Minneapolis, 2007
at the COE-21 workshop, Misasa (Japan), 2008
at the workshop “Transport Properties of the Lower Mantle”, Nikko (Japan), 2008
at workshop on “Long Range Plan for High Pressure Earth Science”, Tempe, 2009
at “European Intensive Seminars on Petrology” at Gradana (Spain), 2009
at “Geodynamical Phenomena” at Suzdal (Russia), 2009
at “International Seminar Series” at Ehime GRC (Japan), 2009
at “Earth’s Dynamics” at Tohoku University, 2010
at “Multi-scale Continental Dynamics” at Wuhan (China), 2010
at “LEAPS workshop” at Pasadena, 2010
at “Gordon-Kenan Research Seminar”, Mt Holyoke, 2011
at “GeoPrism” workshop at Austin, 2011
at “ISSI-workshop” at Bern (Switzerland), 2011
at “IUGG”, Melbourne (Australia), 2011
at “Mantle Convection and Lithospheric Dynamics”, Döllnsee (Germany), 2011
at “EarthScope” workshop, Portland (Oregon), 2011
at “Inter-Ridge” workshop, Tokyo (Japan), 2011
at “Water Dynamics - 9“, Sendai (Japan), 2012
at EGU (Vienna), 2012
at “Across the Earth into Exoplanets“ workshop, Suma (Japan), 2012
at “Geophysics of Slab Dynamics”, Jeju Island (Korea), 2012
at “TANDEM meeting”, Ehime (Japan), 2013
at “Allday lecture”, Texas Austin, 2013

at EGU (Vienna), 2013
at "Gordon Research Conference" (discussion chair), 2013
at "Attenuation workshop", Lamont-Doherty, 2013
at "Love medal lecture" at EGU (Vienna), 2014
at "Frontiers in Planetary Science" (Toronto), 2014
at "LAB-2015" (London), 2015
at "Normal Oceanic Mantle" at Matsushima (Japan), 2015
at "Japan Geoscience Union" at Makuhari (Japan), 2015
at ISSI workshop "Acquisition of water to planets" (Bern), 2016
at a workshop on "Flow in the Deep Earth" (Paris), 2016

Invited seminars (2000-)

Yale University, 2000
UCLA, 2000
University of Michigan, 2000
Woods Hole Oceanographic Institution, 2001
Brown University, 2001
Arizona State University, 2002
Columbia University, 2002
Ruhr-University-Bochum, 2002
Princeton University, 2003
Ehime University, 2003
Tohoku University, 2003
Rice University, 2003
Woods Hole Oceanographic Institution, 2003
Nagoya University, 2004
University of Washington, 2004
US Naval Research Observatory, 2006
Tohoku University, 2007
Virginia Tech, 2007
Boston University, 2007
University of California, Santa Cruz, 2008
Hiroshima University (Japan), 2008
University of Minnesota, 2009
Seoul National University (Korea), 2009
Kyushu University (Japan), 2009
Tohoku University (Japan), 2009
Ehime University (Japan), 2009
Tohoku University (Japan), 2010
Charles University (Czech), 2010
Charles University (Czech), 2011
Carnegie Institution of Washington, 2011
Tohoku University (Japan), 2011
Tohoku University (Japan), 2012
Seoul National University (Korea), 2012
Washington University at St. Louis, 2012
Charles University (Czech), 2012

Czech Academy (Czech), 2012
Chiba University (Japan), 2012
University of Tokyo (Japan), 2013
Tokyo Institute of Technology (Japan), 2013
University of Texas Austin, 2013
University of Copenhagen, 2013
Northwestern University, 2013
University of Western Ontario, 2013
University of Toronto, 2014
Australian National University, 2014
Macquarie University, 2014
Tokyo Institute of Technology, 2014
Tohoku University, 2014
Case Western Reserve University, 2015
Tohoku University, 2015
Earth Observatory of Singapore, 2015
Ehime University, 2016
University of Tokyo, 2016
Earth Observatory of Singapore, 2016
University of Edinburg, 2016
Columbia University, 2017
Macquarie University (Australia), 2017
Australian National University, 2017

Professional Society Memberships

Physical Society of Japan
American Geophysical Union
Mineralogical Society of America
The Planetary Society
European Geophysical Union

Professional Activities

Convenor, Symposium on Plasticity of Solids and Rheology of the Earth, Tokyo 1985
Convenor, Symposium on the Earth's Deep Interior and Dynamics of Subducting Slabs held during IASPEI meeting at Istanbul 1989
Convenor, Symposium on physical properties of rocks and minerals held during IGC meeting at Kyoto 1992
Convenor, Symposium on Rheology and Lithospheric deformation, IUGG, Boulder, CO 1995
Co-chairman, Inter-Union Commission of Lithosphere, Working Group 6 (Structure, Physical Properties, Composition, and Dynamics) 1985-1990
Member, Physical Properties of Earth Materials (AGU) 1992-1994
Chairman, Mineral and Rock Physics Committee (AGU) 1996-1998
Member, Wave Propagation (Anisotropy) (IASPEI) 1995-present
Convenor, Seismic anisotropy (IUGG) 1999

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| Advisory Committee of CSEDI | 1999- |
| Advisory Committee of IFREE (Institute for Frontier Research on Earth Evolution) | 2001- |
| Member, NSF geophysics panel | 2001-2004 |
| Advisory Committee of NRC (National Academy of Science) | 2001-2004 |
| Executive Committee of COMPRES | 2002-2005 |
| Convenor of MSA workshop "Plastic Deformation" | 2002 |
| Member of Science Council of Japan | 2006-2009 |
| Co-convenor of an AGU session | 2006 |
| Co-convenor of an AGU session | 2007 |
| Convenor of a session (mantle mineralogy and rheology) for IGC-33 | 2008 |
| Co-convenor of a session (Earth's deep interior) for IGC-33 | 2008 |
| Convenor of a workshop "Rheology Grand Challenge" | 2008 |
| Convenor of an AGU session (mantle convection and rheology) | 2011 |
| Co-convenor of an AGU session (asthenosphere) | 2013 |
| Co-convenor of an AGU session (volatiles) | 2014 |
| Co-convenor of a JpGU session (rheology) | 2015 |

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| Member of review committee for the Department of Earth and Planetary Sciences at Hokkaido University (Japan), | 1997 |
| Member of review committee for the Department of Earth and Space Sciences at State University of New York at Stony Brook, | 1999 |
| Member, Executive committee of Institute for Study of Earth's Interior at Misasa | 2005-2008 |
| Chair of review committee for the IFREE (Japan) | 2012, 2013, 2014 |
| Advisory Committee for the IFREE (Japan) | 2012-2014 |
| Chair of review committee for the Department of Earth and Planetary Sciences at University of Tokyo | 2013 |
| Chair of review committee for the Department of Earth and Planetary Sciences at Tokyo Institute of Technology | 2013 |
| Advisory panel of VLab (University of Minnesota) | 2004-2010 |
| Board Member of Solid Earth Section, JpGU | 2012-present |
| Officer of Geodynamics division of EGU | 2013-present |
| Member of Bowie Medal Committee of AGU | 2017- |

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| Editorial Board of *Tectonophysics* | 1992-2008<br>2012-present |
| Associate Editor of *Journal of Geophysical Research - Red* | 1998-2006 |
| Editor of *Pure and Applied Geophysics* | 1998-2013 |
| Editorial Board of *Journal of Geodynamics* | 1998-2007 |
| Reader Panel of *Nature* | 2009-2010 |
| Editorial Board of *Surveys in Geophysics* | 2009-present |
| Editorial Board of *Progress in Earth and Planetary Sciences* | 2013-present |
| Editorial board of *Frontiers in Earth Sciences* | 2014-present |

Publications

1. Karato, S. and Ida, Y., 1977. Physical properties of partially molten materials, *Bull. Volcano. Soc. Japan.*, 22: 221-222.

2. Toriumi, M. and Karato, S., 1978. Experimental studies on the recovery process of deformed olivines and the mechanical state of the upper mantle, *Tectonophysics,* 49: 79-95.

3. Karato, S., 1979. Rheology of the mantle and the dynamics of the earth, *Earth Monthly,* 1: 837-844.

4. Karato, S. and Toriumi, M., 1980. Experimental studies on the recovery process of deformed olivines and the mechanical state of the upper mantle- Reply, *Tectonophysics,* 65: 186-192.

5. Karato, S., 1980. Low Q zone at the base of the mantle: evidence for lower mantle convection?. *Phys. Earth Planet. Inter.*, 22: 155-161.

6. Karato, S., Toriumi, M. and Fujii, T., 1980. Dynamic recrystallization of olivine single crystals during high-temperature creep, *Geophys. Res. Lett.,* 7: 649-652.

7. Toriumi, M., Karato, S. and Fujii, T., 1980. Dislocation structures of olivine and the stress in the upper mantle, *Earth Monthly*, 2: 573-577.

8. Matsui, T., Karato, S. and Yokokura, T., 1980. Dislocation structures of olivine from pallasite meteorites, *Geophys. Res. Lett.*, 7: 1007-1010.

9. Matsui, T., Karato, S. and Yokokura, T., 1980. Stress histories retained in olivines from pallasite meteorites, *Proc. Lunar Planet. Sci. Conf.,* 11th, 1047-1054.

10. Karato, S., 1981. Rheology of the lower mantle, *Phys. Earth Planet. Inter.*, 24: 1-14.

11. Karato, S., 1981. Pressure dependence of diffusion in ionic solids, *Phys. Earth Planet. Inter.*, 25: 38-51.

12. Karato, S., 1981. Comment on "The effect of pressure on the rate of dislocation recovery in olivine", *J. Geophys. Res.*, 86: 9319.

13. Honnorez, J., Von Herzen, R.P., Karato, S., et al., 1981. Hydrothermal mounds and young ocean crust of the Galapagos Preliminary Deep Sea Drilling results, Leg 70, *Geol. Soc. Amer. Bull.,* 92: 457-472.

14. Karato, S., 1982. Rheology of the mantle materials, *Shizen,* 37: 40-47.

15. Karato, S., Toriumi, M. and Fujii, T., 1982. Dynamic recrystallization and high-temperature rheology of olivine, In: High Pressure Research in Geophysics (ed. S.

Akimoto and M.H. Manghnani), Center for Academic Publications Japan, Tokyo, pp. 171-189.

16. Karato, S., 1982. Recovery and recrystallization in olivine, In: *Strength of Metals and Alloys*, (ed. R.C. Gifkins), Pergamon Press, Oxford and New York, pp. 753-756.

17. Karato, S. and Ogawa, M., 1982. High-pressure recovery of olivine: implications for creep mechanisms and creep activation volume, *Phys. Earth Planet. Inter.*, 28: 102-117.

18. Karato, S. and Sato, H., 1982. Effect of oxygen partial pressure on the dislocation recovery in olivine: a new constraint on creep mechanisms, *Phys. Earth Planet. Inter.,* 28: 312-319.

19. Cann, J.R., Von Herzen, R.P., Karato, S., et al., 1982. Geothermal regimes of the Costa Rica Rift, east Pacific, investigated by drilling, DSDP-IPOD Legs 68, 69 and 70, *Geol. Soc. Amer. Bull.*, 93: 862-875.

20. Karato, S. and Becker, K., 1983. Porosity and hydraulic properties of sediments from the Galapagos Spreading Center and their relation to hydrothermal circulation in the oceanic crust, *J. Geophys. Res.,* 88: 1009-1017.

21. Karato, S., 1983. Physical properties of basalts from the Galapagos, Leg 70, In: Initial Report of the Deep Sea Drilling Project, vol.LXX, (ed. J. Honnorez and R.P. Von Herzen), pp. 423-428.

22. Karato, S. and Becker, K., 1983. Physical properties of sediments from the Galapagos region and their implications for hydrothermal circulation, In: Initial Report of the Deep Sea Drilling Project, vol.LXX, (ed. J. Honnorez and R.P. Von Herzen), U.S. Government Printing Office, Washington, D.C., pp. 355-368.

23. Karato, S., 1983. Physical properties of basalts from Deep Sea Drilling Project Hole 504B, Costa Rica Rift, In: Initial report of the Deep Sea Drilling Project, vol.LXIX, (ed. J.R. Cann, M.G. Langseth, J. Honnorez, R.P. Von Herzen, and S.M. White), U.S. Government Printing Office, Washington, D.C., pp. 687-695.

24. Karato, S., Wilkens, R.H. and Langseth, M.G., 1983. Shipboard physical properties measurements of basalts from the Costa Rica Rift, Deep Sea Drilling project Legs 69 and 70, In: Initial Report of the Deep Sea Drilling Project, vol.LXIX, (ed. J.R. Cann, M.G. Langseth, J. Honnorez, R.P. Von Herzen, and S.M. White), U.S. Government Printing Office, Washington, D.C., pp. 675-681.

25. Becker, K., Von Herzen, R.P. and Karato, S., 1983. Geothermal measurements from drilling of sediments near the Galapagos Spreading Center, 86ÅãW, Deep Sea Drilling Project Leg 70, In: Initial Report of the Deep Sea Drilling Project, vol.LXX, (ed. J. Honnorez and R.P. Von Herzen), U.S. Government Printing Office, Washington, D.C., pp. 445-458.

26. Toriumi, M., Karato, S. and Fujii, T., 1984. Transient and steady state creep of olivine, In: *Material Science of the Earth's Interior,* (ed. I. Sunagawa), Terra Scientific Publishing Company, Tokyo, pp. 281-300.

27. Karato, S., 1984. Grain-size distribution and rheology of the upper mantle, *Tectonophysics,* 104: 155-176.

28. Karato, S., 1984. Comment "Viscosity and conductivity of the lower mantle; an experimental study on a $MgSiO_3$ perovskite analogue: $KZnF_3$", *Phys. Earth Planet. Inter.,* 34: 271-274.

29. Toriumi, M. and Karato, S., 1985. Preferred orientation development of dynamically recrystallized olivine during high temperature creep, *J. Geol.*, 93: 407-417.

30. Karato, S., Paterson, M.S. and Fitz Gerald, J.D., 1986. Rheology of synthetic olivine aggregates: influence of grain size and water, *J. Geophys. Res.,* 91: 8151-8176.

31. Karato, S., 1986. Does partial melting reduce the creep strength of the earth's upper mantle?, *Nature,* 319: 309-310.

32. Karato, S. and Toriumi, M. (eds.), 1986. *Rheology of Solids and of the Earth*, Tokai University Press, Tokyo, pp. 352.

33. Karato, S. and Toriumi, M., 1986. Rheology of the earth, In: *Rheology of Solids and of the Earth*, (eds. S. Karato and M. Toriumi), Tokai University Press, Tokyo, pp. 15-24.

34. Karato, S., 1986. Plasticity of olivine, In: *Rheology of Solids and of the Earth,* (eds. S. Karato and M. Toriumi), Tokai University Press, Tokyo, pp. 108-124.

35. Karato, S., 1986. Mechanisms of seismic anisotropy: physical basis of the structural geology of the mantle, In: *Rheology of Solids and of the Earth,* (eds. S. Karato and M. Toriumi), Tokai University Press, Tokyo, pp. 312-333.

36. Karato, S., 1987. Seismic anisotropy due to lattice preferred orientation of minerals: kinematic or dynamic?, In: *High Pressure Research in Mineral Physics*, (eds. M.H. Manghnani and Y. Syono), Terra Pub., Tokyo, pp. 317-333.

37. Karato, S., 1987. Scanning electron microscope observation of dislocations in olivine, *Phys. Chem. Minerals*, 14: 245-248.

38. Karato, S., 1988. The role of recrystallization in preferred orientation of olivine, *Phys. Earth Planet. Inter.*, 51: 107-122.

39. Karato, S., 1988. Rock-forming minerals, In: *Earth Science Illustrated* (eds. A. Sugimura, Y. Ida, and Y. Nakamura), Iwanami Shoten, pp. 60-71.

40. Karato, S., 1989. Grain growth kinetics in olivine aggregates, *Tectonophysics*, 168: 255-273.

41. Karato, S. and Toriumi, M. (editors), 1989. *Rheology of Solids and of the Earth,* Oxford University Press, pp. 440. (revised and enlarged version of 32).

42. Karato, S., 1989. Defects and plastic deformation in olivine, In: *Rheology of Solids and of the Earth* (eds., S. Karato and M. Toriumi), Oxford University Press, pp. 176-208.

43. Karato, S., 1989. Seismic anisotropy: mechanisms and tectonic implications, In: *Rheology of Solids and of the Earth* (eds., S. Karato and M. Toriumi), Oxford University Press, pp. 393-422.

44. Karato, S. and Masuda, T., 1989. Anisotropic grain growth in quartz aggregates under stress and its implications for foliation formation, *Geology,* 17: 695-698.

45. Karato, S., 1989. Plasticity-crystal structure systematics in dense oxides and its implications for the creep strength of the Earth's deep interior: a preliminary result, *Phys. Earth Planet. Inter.*, 55: 234-240.

46. Kawasaki, I., S. Karato and T. Ouchi, 1989. Regional structure and origin of the low velocity zone, *Zishin* (Journal of the Seismological Society of Japan), 42: 239-254.

47. Takeshita, T. and S. Karato, 1989. Anisotropy in the earth formed by plastic flow, *Zishin,* 42: 255-269.

48. Karato, S., 1989. Petrophysics and geodynamics, *Butsuri* (Journal of Physical Society of Japan), 44: 725-732.

49. Karato, S. and H.A. Spetzler, 1990. Defect microdynamics in minerals and the mechanisms of seismic wave attenuation and velocity dispersion, *Rev. Geophys.*, 28: 399-421.

50. Karato, S. , K. Fujino and E. Ito, 1990. Plasticity of $MgSiO_3$ perovskite: The results of microhardness tests, *Geophys. Res. Lett.,* 17: 13-16.

51. Karato, S. 1990. The role of hydrogen in the electrical conductivity of the upper mantle, *Nature*, 347: 272-273.

52. Karato, S., 1991. Origin of geophysical anomalies in the mantle: recent progress in rock physics, *Earth Monthly*, 13: 397-400.

53. Karato, S., 1991. Flow and fracture of rocks: a review of laboratory studies, *Zishin*, 44: 233-244.

54. Karato, S., 1991. Mineral physics observations pertinent to the dynamics of the Earth's interior, *Mineral.J.Japan,* 20: 217-224.

55. Karato, S., 1992. Rock rheology and mass transport in the solid earth, In: *Encyclopedia of Earth System Science* (Academic Press), vol. 4, 31-37.

56. Karato, S. and E. Ohtani, 1992. Earth, Interior Structures of the, In: *Encyclopedia of Applied Physics,* edited by G.L. Trigg, E.S. Vera, and W. Greulich, VCH Publishers, vol.5, pp.127-148.

57. Karato, S. and P. Li, 1992. Diffusion creep in the perovskite : Implications for the rheology of the lower mantle, *Science.* 255: 1238-1240.

58. Karato, S., 1992. On the Lehmann discontinuity, *Geophys. Res Lett.,* 19: 2255-2258.

59. Rubie, D.C., S. Karato, H.Yan and O'Neill,H.St. C., 1993. Low differential stress and controlled chemical environment in multianvil high-pressure experiments, *Phys.Chem.Mineral.,* 20: 315-322.

60. Karato, S., D.C. Rubie and H. Yan, 1993. Dislocation recovery in olivine under deep upper mantle conditions: implications for creep and diffusion, *J. Geophys. Res.,* 98: 9761-9768.

61. Fischer, G., Z.Wang and S.Karato, 1993. Elasticity of $CaTiO_3$, $SrTiO_3$, and $BaTiO_3$ perovskites up to 3 GPa: the effect of crystallographic structure, *Phys. Chem. Minerals.*, 20: 97-103.

62. Karato, S. and P.Wu, 1993. Rheology of the upper mantle: A synthesis, *Science.* 260: 771-778.

63. Wang, Z., S. Karato, and K. Fujino, 1993. High temperature creep of $SrTiO_3$: A contribution to creep systematics in perovskites, *Phys.Earth Planet.Inter.,* 79: 299-312.

64. Fujino, K., H.Nakazaki, H.Momoi, S.Karato, and D.L.Kohlstedt, 1993. TEM observation of dissociated dislocations with b=[010] in naturally deformed olivine, *Phys.Earth Planet.Inter.,* 78: 131-137.

65. Karato, S., 1993. Importance of anelasticity in the interpretation of seismic tomography, *Geophys. Res. Lett.,* 20: 1623-1626.

66. Karato, S., 1993. Inner core anisotropy due to magnetic field induced preferred orientation of iron, *Science,* 262: 1708-1711.

67. Karato, S., 1994. A hard garnet layer and its role on the fate of subducting slabs, *Chikyu.,* 9: 112-120.

68. Karato, S. 1994. Dynamics of the deep mantle: seismic tomography, mineral physics and mantle convection, *Kagaku,* 64: 296-305.

69. Karato, S., Z. Wang and K. Fujino, 1994. High temperature creep in yttrium aluminum garnet, *J.Mater.Sci.*,29: 6458-6462.

70. Obata, M., and S. Karato, 1995. Ultramafic pseudotachylyte from Balmuccia peridotite, Ivrea-Verbano zone, northern Italy, *Tectonophysics.* 242: 313-328.

71. Karato, S., Z. Wang, B. Liu and K. Fujino, 1995. Plastic deformation of garnets: systematics and implications for the rheology of the mantle transition zone, *Earth Planet. Sci. Lett.,* 130: 13-29.

72. Zhang, S. and S. Karato, 1995. Lattice preferred orientation in olivine due to shear deformation, *Nature*, 375: 774-777.

73. Karato, S., S. Zhang and H-R. Wenk,1995. Superplasticity in the Earth's lower mantle: Evidence from seismic anisotropy and rock physics, *Science*, 270: 481-484.

74. Karato, S., 1995. Effects of water on seismic wave velocities in the upper mantle, *Proc. Japan Academy* , 71B: 61-66.

75. Karato, S. and T-F. Wong, 1995. Rock deformation: ductile and brittle (US report for IUGG), *Rev. Geophys.* Suppl., 451-457.

76. Karato, S., 1995. Interaction of chemically stratified subducted oceanic lithosphere with the 660 km discontinuity, *Proc. Japan Academy,* 71B: 203-207.

77. Paola, C., Alexander, E.C., Edwards, R.L., Hudleston, P.J., Ito, E., Karato, S., Kelts, K.R., Kleispehn, K.L., Moskowitz, B.M., Person, M., Seyfried, W.E., Sloan, R.E., Stout, J., Teyssier, C. and Tikoff, B., 1995. Geodynamics as the center of a new Earth science curriculum and theme of a new undergraduate laboratory, *J. Geol. Edu.* 43(5): 485-491.

78. Dässler, R., D.A. Yuen, S. Karato, and M.R. Riedel, 1996. Two-dimensional modeling of thermo-kinetic coupling and the consequences on the phase boundaries of subducting slabs, *Phys. Earth Planet. Inter.,* 94: 217-239.

79. Wang, Z., S. Karato and K. Fujino, 1996. High temperature creep in single crystals of gadolinium gallium garnet, *Phys. Chem. Mineral.*, 23: 73-80.

80. Riedel, M.R. and S. Karato, 1996. Microstructural development during nucleation and growth, *Geophys. J. Int.,* 125: 397-414.

81. Li, P., S. Karato and Z. Wang, 1996. High-temperature creep of fine-grained polycrystalline $CaTiO_3$, *Phys. Earth Planet. Inter.*, 95: 19-36.

82. Karato, S., 1996. Rheology of rocks, In *Earth and Planetary Science* (edited by A. Sumi, A. Taira, M. Toriumi and T. Matsui), Iwanami Shoten, Tokyo, vol.6: pp. 239-291.

83. van Keken, P.E., Karato, S. and Yuen, D.A., 1996. Rheological control of oceanic crust separation in the transition zone, *Geophys. Res. Lett.,* 23: 1821-1824.

84. Getting, I.C., Dutton, S.J., Burnley, P.C., Karato, S., and Spetzler, H.A., 1997. Shear attenuation and dispersion in MgO, *Phys. Earth Planet. Inter.*, 99: 249-257.

85. Karato, S., 1997. Phase transformations and rheological properties of mantle minerals, In "*Earth's Deep Interior (Doornbus volume)*" (edited by D. Crossley), Gordon and Breach, pp. 223-272.

86. Karato, S., 1997. On the separation of crustal component from subducted oceanic lithosphere near the 660 km discontinuity, *Phys. Earth Planet. Inter.* 99: 103-111.

87. Karato, S. and Murthy, V.R., 1997. Core formation and chemical equilibrium in the Earth - I. Physical considerations, *Phys. Earth Planet. Inter.,* 100: 61-79.

88. Murthy, V.R. and S. Karato, 1997. Core formation and chemical equilibrium in the Earth - II. Chemical consequences for the mantle and core, *Phys. Earth Planet. Inter.*, 100: 81-95.

89. Riedel, M.R. and Karato, S., 1997. Grain-size evolution in subducted oceanic lithosphere associated with the olivine-spinel transformation and its effects on rheological weakening, *Earth Planet. Sci. Lett.,* 148: 27-43.

90. Karato, S., 1997. Evolution of the oceanic lithosphere, *Kagaku*, 67: 379-389.

91. Karato, S. and Rubie, D.C., 1997. Toward an experimental study of deep mantle rheology: a new multi-anvil sample assembly for deformation experiments under high pressures and temperatures, *J. Geophys. Res.,* 102: 20,111-20,122.

92. Riedel, M.R. and Karato, S., 1997. Rheological weakening of subducted slabs due to the persistence of metastable olivine down to 600 km depth, In *Upper Mantle Heterogeneities from Active and Passive Seismology* (edited by K. Fuchs), Kluwer Academic Pub., Netherlands, pp. 325-332.

93. Karato, S., 1998. Seismic anisotropy in the deep mantle, boundary layers and geometry of mantle convection, *PAGEOPH* , 151: 565-587.

94. Karato, S., Zhang, S., Zimmerman, M.E., Daines, M.J. and Kohlstedt, D.L., 1998. Shear deformation of mantle materials: towards the structural geology of the mantle, *PAGEOPH,* 151: 589-603.

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