

Susan (Elizabeth) Werner Kieffer

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- Position** Professor Emerita Center for Advanced Study Professor of Geology and Physics, and Walgreen University Chair,
- Education** Ph.D., California Institute of Technology, Pasadena, California; planetary sciences; 1971.
M.S., California Institute of Technology, Pasadena, California; geological sciences; 1967.
University of Colorado, Boulder, Colorado, astrogeophysics (solar physics) 1964–1965, (no degree).
B.S., Allegheny College, Meadville, Pennsylvania, physics/mathematics, 1960–1964; magna cum laude with honors in physics; Phi Beta Kappa.
- Academic Interests** Geological physics, nonlinear processes and nonlinear data analysis, stability and sustainability.
Geological physics interests include:
- planetary sciences;
 - geological fluid dynamics—including geothermal, epithermal, and volcanic environments;
 - solid-state geophysics and mineral thermodynamics;
 - shock wave physics;
 - river hydraulics and river environments;
- Professional Experience** **MacArthur Fellow**, (1995–).
- Co-Founder of Kieffer & Woo, Inc. (Canadian company)**, (1996–2000), a small business for analysis of nonlinear data and prediction of processes; ventures in multidisciplinary, multimedia science and in science education, with Dr. M. L. Woo, Ottawa, and (1998–2000). Continued as S.W. Kieffer Science Consulting Inc. April 23, 2000. Founder of Accessible Science Inc. (U.S.A.).
- Co-Founder and President of The Kieffer Institute for Development of Science-Based Education**, a non-profit Institute based in Arizona for development of curriculum material for at-risk K-12 students. Dissolved December 1999.
- Professor of Geological Sciences** at University of British Columbia (August 1993 – December 1995) and **Head of Geological Sciences** (August 1993 – April 1995).
- Chair, Canadian Geoscience Council (CGC) committee (GAND) to review of Canada’s proposed Concept for Geologic Disposal of High-Level Nuclear Fuel Waste** and to participate in public hearings on this topic (summer, 1996). Officially seconded for 6 months by UBC to the CGC (April 1995 – December 1995).

Regents' Professor of Geology, Arizona State University (July 1, 1991 – July 31, 1993).

Professor of Geology, Arizona State University (January 3, 1990 – May 31, 1991); also retained title “scientist emeritus” without remuneration with the U.S. Geological Survey.

Geologist, U.S. Geological Survey, Flagstaff, Arizona. (July 1979 – September 1990) Promoted to “supergrade” (SP-1305) on July 3, 1988. Leave taken for two teaching experiences:

Research Professor of Geology, Arizona State University (January 1 – May 15, 1989).

Visiting Professor of Geology, California Institute of Technology (January – March 1982).

Assistant Professor of Geology, University of California, Los Angeles (June 1973 – June 1979) with promotion to Associate Professor. From June 1978 – July 1979, on research leave of absence. Geologist, U.S. Geological Survey, Flagstaff, Arizona. Prior to this, post-doctoral fellow at UCLA and California Institute of Technology, directly out of graduate school (see above)

Awards and Honorary Degrees **Alfred P. Sloan Foundation Fellowship**, 1977–1979 (award to outstanding young scientist under age of 35).

Mineralogical Society of America Award, 1980 (for scientist under age 35 for outstanding contributions to mineralogy).

W. H. Mendenhall Lecturer (First), U.S. Geological Survey, 1980 (annual honorary lectureship to present state-of-the-art science to colleagues and administrators).

U.S.G.S. Group Achievement Cash Award as Member of Observation and Monitoring Group, Mt. St. Helens, March 27 – July 31, 1980 (for work before, during, and after the eruptions of Mount St. Helens in the spring on 1980).

California Institute of Technology, Distinguished Alumnus Award, 1982 (equivalent to Honorary Ph.D. at other institutions).

Member, National Academy of Sciences, 1986–present (approximately 1615 total members; 150 geologists and geophysicists).

Department of Interior Meritorious Service Award, April 1987.

Doctor of Science Honoris Causa (Honorary Doctor of Science), Allegheny College, 1987.

Fellow, American Academy of Arts and Sciences, 1988 (approximately 3000 Fellows; 163 members in the section 'Earth Sciences and Astronomy').

Spendiarov Award from the USSR Academy of Sciences, presented at the 28th International Geologic Congress, 1989 (presented to an outstanding geoscientist in the host country of the International Geologic Congress each four years; for contributions “to our knowledge of the Earth and the Planets and for her prolific research in fields varying from volcanology and planetology to thermodynamics and river hydraulics”).

Day Medal from the Geological Society of America, presented October 1992 (for “distinct contributions to geologic knowledge through the application of physics and chemistry to the solution of geologic problems”).

MacArthur Fellow, 1995–2000, “in recognition of your accomplishments in geology which demonstrate your originality, creativity, capacity for self-direction, and ability to make a contribution to our lives. Our hope is that the award will provide you with a period of greater freedom from financial and institutional constraints, during which you may devote yourself more fully to your own endeavors. Such a period, we hope, will lead to discoveries or acts on behalf of society that might otherwise not be made.”

Penrose Medal of the Geological Society of America to be presented October 2014

American Philosophical Society to be inducted spring, 2015

Who’s Who...

Who’s Who in America; Who’s Who of American Women; American Men and Women of Science; World Who’s Who of Women; Who’s Who in the West; Dictionary of International Biography; Canadian Who’s Who; International Who’s Who of Professional and Business Women; Who’s Who in the Midwest; Who’s Who in Finance and Business; cited in BCWoman (November 1995)

“Women to Watch” under category “Saving the World” for sense of social responsibility in working on the geological aspects of burying Canada’s high-level nuclear wastes.

Professional

American Geophysical Union (member, 1971; Fellow, 1985);
Geological Society of America (member, 1976; Fellow, 1982);
Mineralogical Society of America (member, 1976; Fellow, 1981);
Sigma Xi (member, 1980);
Meteoritical Society (member, 1971; Fellow, 1986);
Geological Association of Canada (member, 1994);
Mineralogical Association of Canada (member, 1994);
Canadian Geophysical Union (member, 1994);
Cordilleran Roundup of BC (member, 1995);
Society of Canadian Women in Science and Technology, SCWIST (member 1994);
American Association for the Advancement of Science (member 1995; Fellow 2000);
**Elected Chair of Geology/Geography Section, 2002–2005;
International Association for Promoting Geoethics, Vice President, 2013-

**Publications in
Journals**

1. Zirin, H. and *Werner (Kieffer), S.*, Detailed analysis of flares, magnetic fields and activity in the sunspot group of September 13–26, 1963, **Solar Physics**, **1**, 66–100, 1967.
2. *Kieffer, S. W.*, I. Shock Metamorphism of the Coconino Sandstone at Meteor Crater, Arizona: II. The Specific Heat of Solids of Geophysical Interest, **Ph.D. Thesis**, California Institute of Technology, Pasadena, California, 1970.
3. *Kieffer, S. W.*, Shock metamorphism of the Coconino Sandstone at Meteor Crater, Arizona, **Journal of Geophysical Research**, **76**, 5449–5473, 1971.
4. *Kieffer, S. W.*, Introduction to the translation of Russian article by L. Firsov, “Concerning the meteoritic origin of the Puchezh-Katunki Crater,” **Meteoritics**, **8**, 223–244, 1973.
5. Shoemaker, E. M. and *Kieffer, S. W.*, **Guidebook to the Geology of Meteor Crater, Arizona**, printed by the Meteoritical Society and the U.S. Geological Survey for the 37th Annual Meeting of the Meteoritical Society, August, 1974.
6. *Kieffer, S. W.*, Phakey, P.P., and Christie, J.M., Microstructural relationships of high-pressure SiO₂ phases produced by shock waves in porous quartzite, **8th International Congress of Electron Microscopy**, Canberra, Australia, August 1974.
7. *Kieffer, S. W.*, Droplet chondrules, **Science**, **189**, 330–340, 1975.
8. *Kieffer, S. W.*, From regolith to rock by shock, **The Moon**, **13**, 301–320, 1975.
9. Gibbons, R. V., *Kieffer, S. W.*, Schaal, R. B., and Horz, F., Experimental calibration of shock metamorphism of basalt, **Proc. of Conf. on the Origins of Mare Basalts and their Implications for Lunar Evolution**, November 17–19, 1975, 44–48, Lunar Science Inst., Houston, Texas.
10. Schaal, R., Horz, F., Gibbons, R. V., and *Kieffer, S. W.*, Impact melts of well characterized lunar and terrestrial basalts, **Proc. of Conf. on the Origins of Mare Basalts and their Implications for Lunar Evolution**, November 17–19, 1975, 144–148, Lunar Science Inst., Houston, Texas.
11. Maupome, L., Alvarez, R., *Kieffer, S. W.*, and Dietz, R. S., On the terrestrial origin of the Tepexitl Crater, Mexico, **Meteoritics**, **10**, 209–214, 1975.
12. *Kieffer, S. W.*, Getting, I. C., and Kennedy, G. C., Experimental determination of the pressure dependence of the thermal diffusivity of teflon, sodium chloride, quartz and silica, **Journal of Geophysical Research**, **81**, 3025–3030, 1975.
13. *Kieffer, S. W.*, Lattice thermal conductivity within the earth and considerations of a relationship between the pressure dependence of the thermal diffusivity and the volume dependence of the Gruneisen Parameter, **Journal of Geophysical Research**, **81**, 3018–3024, 1976.
14. *Kieffer, S. W.*, Phakey, P. P., and Christie, J. M., Shock processes in porous quartzite: transmission electron microscope observations and theory, **Contributions to Mineralogy and Petrology**, **59**, 41–93, 1976.
15. *Kieffer, S. W.*, Schaal, R., Gibbons, R., Horz, F., Milton, D. J. and Dube, A., Shocked basalts from Lonar Impact Crater (India) and experimental analogues, **Proceedings, Seventh Lunar Science Conference**, 1391–1412, 1976.
16. Kerridge, J. F. and *Kieffer, S. W.*, A constraint on impact theories of chondrule formation, **Earth and Planetary Science Letters**, **35**, 35–42, 1977.
17. *Kieffer, S. W.*, Sound speed in liquid-gas mixtures: water-air and water-steam, **Journal of Geophysical Research**, **82**, 2895–2904, 1977.
18. *Kieffer, S. W.*, Impact conditions required for formation of melt by jetting in silicates, **Impact and Explosion Cratering**, Ed. by D. J. Roddy, R. O. Pepin and R. B. Merrill, Pergamon, 751–769, 1977.

19. *Kieffer, S. W.*, Thermodynamic and lattice vibrations of minerals: 1. mineral heat capacities and their relationships to simple lattice vibrational models, **Reviews of Geophysics**, **17**, 1–19, 1979.
20. *Kieffer, S. W.*, Thermodynamics and lattice vibrations of minerals: 2. vibrational characteristics of silicates, **Reviews of Geophysics**, **17**, 20–34, 1979.
21. *Kieffer, S. W.*, Thermodynamics and lattice vibrations of minerals: 3. lattice dynamics and an approximation for minerals with application to simple substances and framework silicates, **Reviews of Geophysics**, **17**, 35–59, 1979.
22. *Kieffer, S. W.* and Delany, J., Isentropic decompression of fluids from crustal and mantle pressures, **Journal of Geophysical Research**, **84**, 1611–1620, 1979.
23. Smith, B. A., Shoemaker, E. M., *Kieffer, S. W.*, and Cook, A. F., The role of SO₂ in volcanism on Io, **Nature**, **280**, 738, 1979.
24. Croft, S. K., *Kieffer, S. W.*, and Ahrens, T. J., Low velocity impact craters in ice and permafrost with implications for Martian crater count ages, **Journal of Geophysical Research**, **84**, 8023–8032, 1979.
25. *Kieffer, S. W.* and Simonds, C., The role of volatiles and lithology in the impact process, **Reviews of Geophysics and Space Physics**, **18**, 143–181, 1980.
26. *Kieffer, S. W.*, Thermodynamics and lattice vibrations of minerals: 4. application to chain, sheet and orthosilicates, **Reviews of Geophysics and Space Physics**, **18**, 862–886, 1980.
27. *Kieffer, S. W.*, Blast dynamics at Mount St. Helens on 18 May 1980, **Nature**, **291**, 568–570, 1981.
28. *Kieffer, S. W.*, The blast at Mount St. Helens: What happened?, **Engineering and Science** (alumni magazine published by Calif. Inst. of Technology), **XLV**(1), 6–12, 1981.
29. *Kieffer, S. W.*, Acceptance of the Mineralogical Society of America Award for 1980, **Amer. Mineral**, **66**, 644–645, 1981.
30. *Kieffer, S. W.*, Fluid dynamics of the May 18 Blast at Mount St. Helens, **U.S.G.S. Prof. Paper 1250**, 379–400, 1982.
31. *Kieffer, S. W.*, Fluid dynamics and thermodynamics of Ionian volcanism, Chapter 18 in **The Satellites of Jupiter**, Ed. D. Morrison, 647–723, 1982.
32. *Kieffer, S. W.*, Thermodynamics and lattice vibrations of minerals: 5. applications to phase equilibria, isotopic fractionation, and high-pressure thermodynamic properties, **Reviews of Geophysics and Space Physics**, **20**(4), 827–849, 1982.
33. Allen, C. C., Jercinovic, M. C., See, T., Keil, K., *Kieffer, S. W.*, and Simonds, C. H., Comments on the paper “Experimental shock lithification of water-bearing rock powders”, **Geophysical Research Letters**, **9**, 1013–1016, 1982.
34. Sturtevant, B., and *Kieffer, S. W.*, Vapor explosions and the blast at Mount St. Helens, **Proceedings of 14th International Symposium on Shock Tubes and Waves**, August 14–17, 1983, Sidney, N.S.W., Australia, 9 pages.
35. *Kieffer, S. W.*, Factors governing the structure of volcanic jets, in **Explosive Volcanism; Inception, Evolution, and Hazards**, report of the National Academy of Sciences, Geophysics Study Committee, Chapter 11, Ed. F. M. Boyd, 143–157, 1984.
36. *Kieffer, S. W.*, Seismicity at Old Faithful Geyser; an isolated source of geothermal noise and possible analogue of volcanic seismicity, **Journal of Volcanology and Geothermal Research**, **22**, 59–95, 1984.

37. *Kieffer, S. W.*, and Sturtevant, B., Laboratory studies of volcanic jets, **Journal of Geophysical Research**, **89**, 8253–8268, 1984.
38. *Kieffer, S. W.*, Volcanoes and atmospheres, **The Planetary Report**, **V**(1), 4–6, 1985. Reprinted as *Kieffer, S. W.*, Volcanoes and Atmospheres: Catastrophic Influences on the Planets, **Earthquakes and Volcanoes**, **18**(2), 76–83, 1986. Translated into Welsh as “Y Llosgfynydd a’r Awyrgylch-Dylanwadau trychinebus ar blanedau”, in Y Gwyddonydd, CCBII, 125–127, 1990.
39. *Kieffer, S. W.*, The 1983 hydraulic jump in Crystal Rapids: implications for river-running and geomorphic evolution in the Grand Canyon, **Journal of Geology**, **93**(4), 385–406, 1985.
40. *Kieffer, S. W.*, and Navrotsky, A., editors, **Microscopic to Macroscopic Atomic Environments to Mineral Thermodynamics**, **Reviews of Mineralogy**, **14**, 428 pp., 1985.
41. *Kieffer, S. W.*, Heat capacity and entropy: systematic relations to lattice vibrations, **Reviews of Mineralogy**, **14**, 65–126, 1985.
42. *Kieffer, S. W.*, Scientific perspective [on Microscopic to Macroscopic: Atomic environments to Mineral Thermodynamics], **Reviews of Mineralogy**, **14**, 1–8, 1985.
43. *Kieffer, S. W.*, Geologic Nozzles, in **Lecture Notes in Physics, Perspectives in Fluid Mechanics**, **320**, Ed. Donald Coles, Springer-Verlag, Berlin, 143–207, 1985.
44. *Kieffer, S. W.*, FORTRAN program for calculation of thermodynamic properties of minerals from vibrational spectra, **U.S. Geological Survey Open File Report 86-475**, 47 pages, 1986.
45. *Kieffer, S. W.*, Hydraulics of the Rapids of the Colorado River, Grand Canyon, Arizona, a 20-minute video, **U.S. Geological Survey Open File Report 86-503**, 1986.
46. *Kieffer, S. W.*, Hydraulic map of House Rock Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map 1897, part A**, Map size = 42” x 58”, 1988.
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49. *Kieffer, S. W.*, Hydraulic map of Horn Creek Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map 1897, part E**, Map size = 42” x 58”, 1988.
50. *Kieffer, S. W.*, Hydraulic map of Crystal Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map 1897, part H**, Map size = 42” x 58”, 1988.
51. *Kieffer, S. W.*, The rapids and waves of the Colorado River, Grand Canyon, Arizona, **U.S. Geological Survey Open-file Report 87-096**, 106 pp., 1987.
52. *Kieffer, S. W.*, and B. Sturtevant, Erosional furrows formed during the lateral blast at Mount St. Helens, May 18, 1980, **J. Geophysical Res.**, **93**(14), 793-14, 816, 1988.
53. *Kieffer, S. W.*, Geologic Nozzles, **Reviews of Geophysics**, **27**(1), 3–38, 1989.
54. *Kieffer, S. W.*, Graf, J. B., and Schmidt, J. C., Hydraulics and sediment transport of the Colorado River, in **Geology of Grand Canyon, Northern Arizona (with Colorado River Guides)**, Ed. D. P. Elston, G. H. Billingsley, and R. A. Young, Field Trip Guidebook T115/T315, American Geophysical Union Publication for the 28th International Geological Congress, Washington, D.C., 44–66, 1989.

55. Graf, J. B., Schmidt, J. C., and *Kieffer, S. W.*, River log of the hydraulic characteristics of the Colorado River and selected rapids, in **Geology of Grand Canyon, Northern Arizona (with Colorado River Guides)**, Ed. D. P. Elston, G. H. Billingsley, and R. A. Young, Field Trip Guidebook T115/T315, American Geophysical Union Publication for the 28th International Geological Congress, Washington, D.C., 37–47, 1989.
56. *Kieffer, S. W.*, Multiphase flow in explosive volcanic and geothermal eruptions, Theoretical and Applied Mechanics, **Proceedings of the XVIIth International Congress of Theoretical and Applied Mechanics**, Grenoble, France, August 21-27, 1988, Ed. P. Germain, M. Piau and D. Caillerie, Elsevier, Amsterdam, Netherlands, 145–171, 1988.
57. *Kieffer, S. W.*, Hydraulic map of Deubendorff Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map 1897, part I**, Map size = 42" x 58", 1988.
58. *Kieffer, S. W.*, Hydraulic map of Bright Angel Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map I-1897-D**, 1988 (this map bears a 1988 date, but publication was in 1989).
59. *Kieffer, S. W.*, Hydraulic map of Hermit Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map I-1897-G**, 1988 (this map bears a 1988 date, but publication was in 1989).
60. *Kieffer, S. W.*, Hydraulic map of 24.5 Mile Rapids, Grand Canyon, Arizona, **U.S. Geological Survey Miscellaneous Investigations Map I-1897-B**, 1988 (this map bears a 1988 date, but publication was in 1989).
61. *Kieffer, S. W.*, The hydraulics and geomorphology of the Colorado River in the Grand Canyon, Chapter 16 in **Grand Canyon Geology**, Ed. by S. S. Beus and M. Morales, 333–383, 1990.
62. *Kieffer, S. W.*, The difficulty and importance of studying geologically rare events and creating permanent scientific and institutional memories of these hazards, Comments at **Workshop on Telluric Disasters at Symposium Planete Terre**, Paris, France, June 12–13, 1989; convened by President Francois Mitterand. Will be published as proceedings of the meeting, possibly in 1990.
63. Soderblom, L. A., Becker, T. L., Brown, R. H., Cook II, A. F., Hansen, C. J., Kirk, R. L., *Kieffer, S. W.*, Shoemaker, E. M. and Johnson, T., Triton's geyser-like plumes: discovery and basic characterization, **Science**, **250**, 410–415, 1990.
64. McMillan, P. F., Lazarev, A. N., and *Kieffer, S. W.*, Lattice dynamics and force fields in crystals, Chapter 6.5.1 in **Advanced Mineralogy**, Volume 2: Methods and Instrumentations: Results and Recent Developments, Ed. by A. S. Marfunin, published by Springer Verlag, Berlin, submitted December 10, 1990, 412, published 1993.
65. Lazarev, A. N., McMillan, P. F., and *Kieffer, S. W.*, Band assignments in infrared and Raman spectroscopy, Chapter 3.6.1 in **Advanced Mineralogy**, Volume 2: Methods and Instrumentations: Results and Recent Developments, Ed. by A. S. Marfunin, published by Springer Verlag, Berlin, submitted December 10, 1990, 174, published 1993.
66. Agoshkov, V. M., *Kieffer, S. W.*, and McMillan, P. F., Lattice dynamics and thermodynamic properties of minerals, Chapter 6.5.2 in **Advanced Mineralogy**, Volume 2: Methods and Instrumentations: Results and Recent Developments, Ed. by A. S. Marfunin, published by Springer Verlag, Berlin, submitted December 10, 1990, 419, published 1993.
67. Levine, A. H. and *Kieffer, S. W.*, A hydraulic model for the August 7, 1980 pyroclastic flow at Mount St. Helens, Washington, **Geology**, **19**, 1121-1124, November, 1991.

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71. Clayton, R. N. and *Kieffer, S. W.*, Oxygen isotopic thermometer calibrations, in **Stable Isotope Geochemistry, Special Publication No. 3 of The Geochemical Society**, Ed. by H. P. Taylor, Jr., J. R. O'Neil, and I. R. Kaplan, 3-10, 1991.
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73. Fink, J. F., and *Kieffer, S. W.*, Pyroclastic flows generated by lava dome collapse, **Nature**, **363**, 612-615, June 1993.
74. *Kieffer, S. W.*, and Morrissey, M. M., Exploring Earth with New Data and New Tools, **Geotimes**, **38**(6), 15-17, June 1993.
75. Kirk, R. L., Soderblom, L. A., Brown, R. H., *Kieffer, S. W.*, and Kargel, J. S., Triton's eruptive plumes: discovery, characteristics, and models, in **Neptune and Triton**, Ed. D. Cruikshank, University of Arizona Press, 949-989, 1995.
76. Westphal, J. A., *Kieffer, S. W.*, and Hutchinson, R. A., Journey Toward the Center of the Earth, a 20-minute narrated video of the descent of a video into the conduit of Old Faithful geyser, not a formal publication, but a very public work on view at the Old Faithful Visitors Center, Yellowstone National Park, 1994.
77. Alvarez, W., Claeys, P., and *Kieffer, S. W.*, Emplacement of KT-Boundary Shocked Quartz from Chicxulub Crater, **Science**, **269**, 930-935, 1995.
78. *Kieffer, S. W.*, Westphal, J. A., and Hutchinson, R. A., Journey Toward the Center of the Earth, **Yellowstone Science**, **3**(3), 1995.
79. *Kieffer, S. W.*, Numerical models of caldera-scale volcanism on Earth, Venus, and Mars, **Science** (invited article), **269**, 1385-1391, 1995.
80. ******, Review of the AECL Environmental Impact Statement on the Concept for Disposal of Canada's Nuclear Fuel Waste, prepared by the "GAND" Committee (The Geoscience Aspects of Nuclear Fuel Waste Disposal), chaired by S. W. Kieffer, August 8, 1995. Not peer reviewed except by the other four committee members. Submitted to the Panel deciding on the future direction of the Concept, 36 pp.
81. Hutchinson, R. A., Westphal, J. A., and *Kieffer, S. W.*, In situ observations of Old Faithful Geyser, **Geology**, **25**, 875-878, 1997.

(***time gap of low-publication rate 1995-2000 because I was using a MacArthur Fellowship, 1995-2000, to develop a private sector company with confidential internal reports still under proprietary constraints; topics were attributes, predictability and prediction in nonlinear systems, including Old Faithful Geyser, sleep apnea, a laser tuned to mimic Rayleigh-Bernard convection in the atmosphere and mantle; sunspot cycles; and daily 10.7 cm radiation; also extensive time working with homeless and at-risk 7-12 grade students developing ways to teach science to this population of students, and to implement the National Science Education Standards at State and District levels. See abstracts***)

82. McEwen, A. S., Lopes-Gautier, R., Kesztheilyi, L., and *Kieffer, S. W.*, Extreme Volcanism on Jupiter's Moon Io, Chapter 7 in **Environmental Effects of Volcanic Eruptions: From Deep Oceans to Deep Space**, Ed. by T. Gregg and J. Zimbelman, Kluwer Academic Publishers, Dordrecht, Netherlands.
83. *Kieffer, S. W.*, Haas, N., and Woods, C., "Scientist Sue": Changing the Way At-Risk Adolescents View Science, reviewed paper for presentation and dissemination at **American Education Research Association**, April 19–23, 1999, Montreal, 4 pp.
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88. *Kieffer, S. W.*, Brown, K. L., Simmons, S. F., and Watson, A., Measured Fluid Flow in an Active H₂O-CO₂ Geothermal Well as an Analog to Fluid Flow in Fractures on Mars: Preliminary Report, Paper #1856, **Lunar and Planetary Conference Proceedings XXXV**, Houston, Texas, March 2004.9.
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90. Pope, K. O., *Kieffer, S. W.*, and Ames, D. E., Empirical and theoretical comparisons of the Chicxulub and Sudbury impact structures, **Meteoritics and Planetary Science**, **39**(1), 97–116, 2004.
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