

John S. Lewis

Curriculum Vitae

Personal:

Born 27 June 1941 in Trenton, NJ.

Married to the former Ruth Margaret Adams, Darien, CT, 1 August 1964.

Six children: John Vandenberg Lewis, Margaret Lewis Martell, Christopher Franklin Lewis, Katherine Lewis Richins, Elizabeth Lewis Reeves, Peter Mandeville Lewis.

Education:

A.B., Chemistry, Princeton University; 1962; National Merit Scholar.

M.A., Inorganic Chemistry, Dartmouth College, 1964; Graduate Teaching Assistant.

Ph.D., Geochemistry and Physical Chemistry, University of California at San Diego, 1968;
NDEA Graduate Research Fellow. Dissertation advisor: Harold C. Urey.

Awards and Honors:

Honorary Lecturer, American Astronomical Society Division of Planetary Sciences, 1974.

James B. Macelwane Award, American Geophysical Union, 1976.

NASA Exceptional Scientific Achievement Medal, 1983.

Space Pioneer Award, National Space Society, 2014.

Professional Experience:

Chief Scientist, Deep Space Industries, 2013-.

Professor Emeritus of Planetary Sciences, Department of Planetary Sciences and Lunar and Planetary Laboratory, University of Arizona, 2007-.

Visiting Professor, Tsinghua University, 2005-06.

Co-Director for Science, NASA/University of Arizona Space Engineering Research Center for Utilization of Local Planetary Resources, 1988-2007.

Professor of Planetary Sciences, Department of Planetary Sciences and Lunar and Planetary Laboratory, University of Arizona, 1982-2007.

Professor of Planetary Sciences, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, 1979-1982.

Visiting Associate Professor of Planetary Sciences, Division of Geological and Planetary Sciences, California Institute of Technology, 1/1/74-3/31/74.

Associate Professor of Geochemistry and Chemistry, Department of Earth and Planetary Sciences and Department of Chemistry, Massachusetts Institute of Technology, 1972-79.

Assistant Professor of Geochemistry and Chemistry, Department of Earth and Planetary Sciences and Department of Chemistry, Massachusetts Institute of Technology, 1968-72.

Affiliations:

NAS/NRC Space Science Board study on the Physics of the Outer Planets, 1969.
NAS/NRC Space Science Board study on Advanced Exploration of Venus, 1970.
JPL Science Advisory Group on exploration of the outer Solar System, 1971-72.
NASA Headquarters Advisory Group on the Outer Planets, 1973.
Faculty, NATO Summer Institute on Planetary Atmospheres, University of Istanbul, 1973.
JPL Mariner Jupiter-Uranus Advisory Committee, 1974.
Contributing Editor, *Comments on Astrophysics and Space Physics*, 1973-76.
Vice Chairman, Gordon Research Conference on Physics and Chemistry of Space, 1973-75.
Visiting Committee, Department of Planetary Sciences and Department of Astronomy, University of Arizona, 1973.
Consultant, Venus Science Steering Group, Centre Nationale des Études Spatiales, 1974.
Chairman, NASA Uranus Science Advisory Committee, 1974-75.
Chairman, IUGG-AIGA Symposium on the Evolution of Planetary Atmospheres, Grenoble, 1-2 Sept., 1975.
NASA Ames Research Center Advisory Committee on Interstellar Communication, 1975.
NASA Physical Sciences Committee, 1975-78.
NAS/NRC Space Science Board *ad hoc* Committee on Biological Contamination of Outer Planets and Satellites, 1975-76.
Co-Investigator, Near-Infrared Mapping Spectrometer, Galileo Jupiter Orbiter, 1977-90.
NAS/NRC Space Science Board study on Comet and Asteroid Missions, 1978.
NASA HQ Planetary Atmospheres Management Operations Working Group, 1979-80.
Associate Editor, *Icarus*, 1980-91.
Space Science Board, NAS/NRC, 1980-83.
Founder and Co-Chairman, Gordon Research Conference on the Origin of Life, 1981-82.
NASA Ames Research Center Advisory Committee on Detection of Extrasolar Planetary Systems, 1983.
IDA Workshop on Defense Applications of Near-Earth Resources, California Space Institute, 1983.
Faculty Fellow, NASA Summer Study on Space Resources, California Space Institute, 1984.
Mars Observer Review Panel, 1985.
NASA Headquarters Planetary Atmospheres Operations Working Group, 1986-89.
Co-Investigator, CRAF Penetrator Probe, 1987-90.
Consultant to the Directorate of Intelligence, CIA on Soviet space activities
Lunar Exploration Science Working Group, NASA, 1988-92.
Board of Directors, American Rocket Company, 1988-95.
NASA Office of Exploration Science Working Group, 1989-92.
Board of Directors, Arizona Space Initiative, 1989-96.
Vice-President for Research, and Director, ASPERA Corporation, 1989-93.
Board of Governors, National Space Society, 1990-.
NASA Long Duration Exposure Facility Advisory Committee, 1990-91.
Chairman, Conference on the Resources of Near-Earth Space, Tucson, 1991.
Commissioner, Arizona State Space Commission, 1991-98.

Board of Advisors, Space Frontier Foundation, 1994-.
Chairman, 12th Conference on Space Manufacturing, Princeton, 1995.
Board of Directors, Space Studies Institute, 1995-.
Advisor, Space Development Corporation NEAP Project, 1997-.
Chairman, 13th Conference on Space Manufacturing, Princeton, 1997.
Advisory Board, *Encyclopedia of Space Science and Technology*, 1998-.
Chairman, Space Frontier Foundation Symposium, "2020 Vision", 1998.
Co-Investigator, LIDAR Experiment, Near-Earth Asteroid Prospector Mission, 1998-.
Discovery Mission Proposal Review Panel, 1998.
Chairman, Advisory Council, The Watch, 1998-.
Consultant, Long-Range Planning Committee of the European Space Agency, 1998.
Chairman, 14th Conference on Space Manufacturing, Princeton, 1999.
Chairman, Space Frontier Foundation Symposium, "Asteroids", 1999.
Chairman, NASA Space Resource Processing Review Panel, 1999.
Advisor, Space Development Corporation Asteroid Prospector Mission, 2000-2002.
Advisor, Center for Study of the Dinosaurian World, University of North Carolina, 2000.
Chairman, 15th Conference on Space Manufacturing, Princeton, 2001.
Chairman, 16th Conference on Space Manufacturing, Princeton, 2003.
Chairman, Senior Advisory Committee, Raytheon, 2004-2005.
Chairman, 17th Conference on Space Manufacturing, Princeton, 2008.
Chairman, 18th Conference on Space Manufacturing, 2010.
NASA Blue Sky Study, Washington DC, 2011.
NASA/INSPIRES Robotics proposal review panel, 2012.
NASA Blue Sky Study, Pensacola, FL, 2013.
NASA/INSPIRES Robotics proposal review panel, 2013.
Chief Scientist, Deep Space Industries, 2014-.

Television Productions:

Living and Working in Space, 1-hour educational TV program on careers in space
Specials for Discovery Channel US, UK, and Canada on comet and asteroid impact
hazards, space resources, and space commercialization
Special on asteroid and comet impacts for the German educational TV series *Welt der
Wunder*.
Guest expert commentator on Chinese Central Television (CCTV9) for the *Shenzhou-6*,
Shenzhou-7, *Shenzhou-9* and *Shenzhou-10* manned missions, *Tiangong 1* space
station module, and the *Chang-e 1* and *Chang-e 2* lunar probes.
Over 60 TV and radio interviews on space-related topics.
Space science and technology specials for the *Science Fiction*, *History*, *Discovery UK*,
Discovery Canada and *Discovery US* Channels.

Prof. John S. Lewis

Biographical Sketch

John S. Lewis is Professor Emeritus of Planetary Sciences and Co-Director of the Space Engineering Research Center at the University of Arizona. He was previously a Professor of Planetary Sciences at MIT. He was a Visiting Associate Professor at California Institute of Technology in 1973 and a Visiting Professor at Tsinghua University in Beijing, PRC for the 2005-2006 academic year.

His research interests are related to the application of chemistry to astronomical problems, including the origin of the Solar System, the evolution of planetary atmospheres, the origin of organic matter in planetary environments, the chemical structure and thermal history of icy satellites, the hazards of comet and asteroid bombardment of Earth, and the extraction, processing, and use of the energy and material resources of nearby space. He served on the Board of Directors of American Rocket Company (AmRoc) during the development of hybrid rocket motors for the private launch business, a process that culminated in the use of an AmRoc-designed motor to propel SpaceShipOne to an altitude of over 100 km and win astronaut's wings for its pilots in 2004. He is presently Chief Scientist for Deep Space Industries, an asteroid-mining company.

He has served as a member or Chairman of a wide variety of NASA and National Academy of Sciences (NAS) advisory committees and review panels. He has written 19 books, including graduate and undergraduate texts and popular science books, and has authored over 150 scientific publications.

He has given invited lectures at over 100 colleges, universities, and research centers throughout the world, including: M.I.T., Harvard, Princeton, Yale, Cornell, Columbia, and Brown Universities, Dartmouth College, the University of Maine, Wellesley College, Smith College, the University of Massachusetts, Amherst College, Tufts University, Mount Holyoke College, Williams College, Woods Hole Oceanographic Institution, Rensselaer Polytechnic Institute, Brooklyn Polytechnic Institute, the State Universities of New York at Stony Brook and Brockport, the University of Pennsylvania, Pennsylvania State University, Old Dominion, Wheeling Jesuit University, Georgia Tech, the College of Wooster, the University of Michigan, the University of Chicago, the University of Minnesota, the University of Iowa, Washington University (St. Louis), the University of Colorado, Western Louisiana State University, Maharishi International University, Utah State University, Brigham Young University, Northern Idaho State University, the University of Arizona, Pima Community College, Arizona State University, the University of Washington, the University of Oregon, the University of California campuses in San Diego, Los Angeles, and Berkeley, San Diego State University, the University of San Diego, the California Institute of Technology, Stanford University, the University of Paris, the University of Istanbul, Kyoto University, Peking University (Bei Jing Da Shue), the center for Space Science and Applied Research and the Center for Lunar Missions of the Chinese Academy of Science, and Tsinghua University (Qing Hua Da Shue).

Publications

1. J.S. Lewis, Polyhedral Borane Free Radicals. *J. Am. Chem. Soc.* **88**, 1068 (1966).
2. H.C. Urey and J.S. Lewis, Organic Matter in Carbonaceous Chondrites. *Science* **152**, 102 (1966).
3. J.S. Lewis, A Possible Origin for Sulfates and Sulfur in Meteorites. *Earth Planet. Sci. Lett.* **2**, 29 (1967).
4. J.S. Lewis, An Estimate of the Surface Conditions of Venus. *Icarus* **8**, 434 (1968).
5. J.S. Lewis, Composition and Structure of the Clouds of Venus. *Astrophys. J.* **152**, L79 (1968).
6. J.S. Lewis and H.R. Krouse, Isotopic Composition of Sulfur and Sulfate produced by Oxidation of FeS. *Earth Planet. Sci. Lett.* **5**, 425 (1969).
7. J.S. Lewis, The Clouds of Jupiter and the NH₃-H₂O and NH₃-H₂S Systems. *Icarus* **10**, 365 (1969).
8. J.S. Lewis, Observability of Spectroscopically Active Compounds in the Atmosphere of Jupiter. *Icarus* **10**, 393 (1969).
9. J.S. Lewis, Geochemistry of the Volatile Elements on Venus. *Icarus* **11**, 367 (1969).
10. J.S. Lewis and R.G. Prinn, Jupiter's Clouds: Structure and Composition. *Science* **169**, 472 (1970).
11. J.S. Lewis, Geochemistry of Venus and the Interpretation of the Radar Data. *Radio Science* **5**, 363 (1970).
12. J.S. Lewis, Ice Clouds on Venus? *J. Atmos. Sci.* **27**, 333 (1970).
13. J.S. Lewis, Venus: Atmospheric and Lithospheric Composition. *Earth Planet. Sci. Lett.* **10**, 73 (1970).
14. J.S. Lewis and R.G. Prinn, Chemistry and Photochemistry of the Atmosphere of Jupiter. In: *Theory and Experiment in Exobiology* (A.W. Schwartz, ed.), Wolters-Noordhoff, Groningen, 123 (1971).
15. J.S. Lewis, Consequences of the Presence of Sulfur in the Core of the Earth. *Earth Planet. Sci. Lett.* **11**, 130 (1971).

16. J.S. Lewis, Satellites of the Outer Planets: Their Physical and Chemical Nature. *Icarus* **15**, 174 (1971).
17. J.S. Lewis, Refractive Index of Aqueous HCl Solutions and the Composition of the Venus Clouds. *Nature* **230**, 295 (1971).
18. J.S. Lewis, Venus: Surface Temperature Variations. *J. Atmos. Sci.* **28**, 1084 (1971).
19. J.S. Lewis, The Atmosphere, Clouds and Surface of Venus. *American Scientist* **59**, 557 (1971).
20. J.S. Lewis, Satellites of the Outer Planets: Thermal Models. *Science* **172**, 1127 (1971).
21. J.S. Lewis, Low-Temperature Condensation from the Solar Nebula. *Icarus* **16**, 241 (1972).
22. J.S. Lewis, Metal/Silicate Fractionation in the Solar System. *Earth Planet. Sci. Lett.* **15**, 286 (1972).
23. J.S. Lewis, Composition of the Venus Cloud Tops in Light of Recent Spectroscopic Observations. *Astrophys. J.* **171**, L75 (1972).
24. The Science Advisory Group, NASA, A Strategy for Investigation of the Outer Solar System. *Space Sci. Revs.* **11**, 1-16 (1972).
25. R.G. Prinn and J.S. Lewis, Atmosphere of Uranus: Structure and Composition. *Astrophys. J.* **179**, 333 (1973).
26. J.S. Lewis, Chemistry of the Outer Solar System. *Space Sci. Rev.* **14**, 401 (1973).
27. K.A. Goettel and J.S. Lewis, Comments on a paper by V.M. Oversby and A.E. Ringwood. *Earth Planet. Sci. Lett.* **18**, 148 (1973).
28. J.S. Lewis, Origin and Composition of the Terrestrial Planets and Satellites of the Outer Planets. In: *The Origin of the Solar System*, C.N.R.S., Paris (1973).
29. J.S. Lewis and R.G. Prinn, Titan Revisited. *Comments Astrophys. Space Phys.* **5**, 1 (1973).
30. S.J. Weidenschilling and J.S. Lewis, Atmospheric and Cloud Structures of the Jovian Planets. *Icarus* **20**, 465 (1973).
31. J.S. Lewis, Chemistry of the Planets. *Ann. Rev. Phys. Chem.* **24**, 339 (1974).
32. K.A. Goettel and J.S. Lewis, Ammonia in the Atmosphere of Venus. *J. Atmos. Sci.* **31**, 828 (1974).

33. J.S. Lewis, Volatile Element Influx on Venus from Cometary Impacts. *Earth Planet. Sci. Lett.* **22**, 239 (1974).
34. J.S. Lewis, The Chemistry of the Solar System. *Sci. Amer.* **230**, No. 3, 50 (1974).
35. J.S. Lewis, Interior and Its Implications for the Atmosphere. In: *The Atmosphere of Titan* (D.M. Hunten, ed.), NASA SP-340, 58 (1974).
36. J.S. Lewis, The Temperature Gradient in the Solar Nebula. *Science* **186**, 440 (1974).
37. S.S. Barshay and J.S. Lewis, Chemistry of Solar Material. In: *The Dusty Universe* G.B. Field and A.G.W. Cameron, eds.), Neale Watson Academic Publ. Inc., New York, 33 (1975).
38. L. Friedman and J.S. Lewis, Future Exploration of Venus. *Astronaut. Aeronaut.* **13**, No. 3, 46 (1975).
39. R.G. Prinn and J.S. Lewis, Phosphine on Jupiter and Implications for the Great Red Spot. *Science* **190**, 274 (1975).
40. S.S. Barshay and J.S. Lewis, Chemistry of Primitive Solar Material. *Ann. Rev. Astron. Astrophys.* **14**, 81 (1976).
41. J.S. Lewis, Equilibrium and Disequilibrium Chemistry of Adiabatic Solar-Composition Planetary Atmospheres. In: *Chemical Evolution of the Giant Planets* (C. Ponnampertuma, ed.), Academic Press, New York, 13 (1976).
42. L. Margulis, J.S. Lewis, H. O. Halvorsen, and A.G.W. Cameron, Limitations to Growth of Terrestrial Microorganisms on Uranus, Neptune and Titan. *Icarus* **30**, 793 (1977).
43. G.J. Consolmagno and J.S. Lewis, Preliminary Thermal History Models of Icy Satellites. In: *Planetary Satellites* (J.A. Burns, ed.), Univ. of Arizona Press, Tucson, 492 (1976).
44. G.J. Consolmagno and J.S. Lewis, Structural and Thermal Models of Icy Galilean Satellites. In: *Jupiter: The Giant Planet* (T. Gehrels, ed.), Univ. of Arizona Press, Tucson, 1035 (1976).
45. L. Margulis, H.O. Halvorsen, J.S. Lewis and A.G.W. Cameron, Some General Principles of Planetary Quarantine Leading to an Assessment of the Limitations of Growth of Microorganisms on Uranus, and Neptune. *COSPAR Life Sciences and Space Research Vol. XV*, Pergamon Press, New York, 101 (1977).

46. S.S. Barshay and J.S. Lewis, Chemical Structure of the Deep Atmosphere of Jupiter. *Icarus* **33**, 593 (1978).
47. G.J. Consolmagno and J.S. Lewis, The Evolution of Icy Satellite Interiors and Surfaces. *Icarus* **34**, 280 (1978).
48. L. Cox, J.S. Lewis, and M. Lecar, A Model for Close Encounters in the Planetary Problem. *Icarus* **34**, 415 (1978).
49. J.S. Lewis, S.S. Barshay, and B. Noyes, Primordial Retention of Carbon by the Terrestrial Planets. *Icarus* **37**, 190 (1979).
50. J.S. Lewis and B. Fegley, Jr., Hot-Atom Synthesis of Organic Compounds on Jupiter. *Astrophys. J.* **232**, L135 (1979).
51. J.S. Lewis and E.P. Ney, Iron and the Formation of Astrophysical Dust Grains. *Astrophys. J.* **234**, 154 (1979).
52. B. Fegley, Jr. and J.S. Lewis, Thermodynamics of Selected Trace Elements in the Jovian Atmosphere. *Icarus* **38**, 166 (1979).
53. M.J. Lupo and J.S. Lewis, Mass-Radius Relationships in Icy Satellites. *Icarus* **40**, 157 (1979).
54. J.S. Lewis and R.G. Prinn, Kinetic Inhibition of CO and N₂ Reduction in the Solar Nebula. *Astrophys. J.* **238**, 357 (1980).
55. B. Fegley, Jr. and J.S. Lewis, Volatile Element Chemistry in the Solar Nebula: Na, K, F, Cl, Br and P. *Icarus* **41**, 439 (1980).
56. M.J. Lupo and J.S. Lewis, Mass-Radius Relationships and Constraints on the Composition of Pluto. *Icarus* **42**, 29 (1980).
57. J.S. Lewis and F.A. Kreimendahl, Oxidation State of the Atmosphere and Crust of Venus from Pioneer Venus Results. *Icarus* **42**, 330 (1980).
58. J.S. Lewis, Lightning Synthesis of Organic Compounds on Jupiter. *Icarus* **43**, 85 (1980).
59. J.S. Lewis, The Origin of the Earth: Planetary Context. In: *The Primitive Earth Revisited* (M.H. Hickman, ed.), University of Miami, Ohio, 5 (1980).
60. J.S. Lewis, Lightning on Jupiter: Rate, Energetics and Effects. *Science* **210**, 1351 (1980).

61. M.J. Lupo and J.S. Lewis, Mass-Radius Relationships and Constraints on the Composition of Pluto II. *Icarus* **44**, 41 (1980).
62. L.P. Cox and J.S. Lewis, Numerical Simulation of the Final Stages of Terrestrial Planet Accretion. *Icarus* **44**, 706 (1980).
63. J.S. Lewis, Putting it All Together. In: *The New Solar System* (B. O'Leary and J.K. Beatty, eds.), Sky Publishing Corp. Cambridge, MA, 205 (1981).
64. G. Consolmagno and J.S. Lewis, Predvaritol'nie Modeli Teplovoi Istorii Ledyanich Sputnikov. In: *Planetary Satellites* (Russian Edition), Mir Publishing House, Moscow, 538 (1981).
65. J.S. Lewis, Io: Geochemistry of Sulfur. *Icarus* **50**, 103 (1982).
66. S. Nozette and J.S. Lewis, Venus: Chemical Weathering of Igneous Rocks and Buffering of Atmospheric Composition. *Science* **216**, 181 (1982).
67. J.S. Lewis and B. Fegley, Jr., Venus: Halide Cloud Condensation and Volatile Element Inventories. *Science* **216**, 1223 (1982).
68. J.S. Lewis, G.H. Watkins, H. Hartman and R.G. Prinn, Chemical Consequences of Major Impact Events on Earth. In: *Geological Implications of Impacts of Large Asteroids and Comets on the Earth* (L.T. Silver and P.H. Schultz, eds.), Geol. Soc. Am. Special Paper 190, 215 (1982).
69. J.S. Lewis and S. Nozette, Extraction and Purification of Iron-Group and Precious Metals from Asteroidal Feedstocks. *Adv. Astronaut. Sci.* **53**, 351 (1983).
70. J.S. Lewis and T. Carroll, Properties and Detectability of Extrasolar Planetary Systems. Submitted (1983).
71. J.S. Lewis, and C. Meinel, Asteroid Mining and Space Bunkers. *Defense Science 2001+*, **2**, No. 3, 33-67 (1983).
72. C. Sagan, B. Khare, and J.S. Lewis, Organic Matter in the Saturn System. In: *Saturn* (T. Gehrels and M.S. Matthews, eds.), Univ. of Arizona Press, Tucson, 788-810 (1984).
73. J.S. Lewis and R.G. Prinn, *Planets and Their Atmospheres: Origin and Evolution*. Academic Press, New York, 470 pp. (1984).
74. J.S. Lewis, and B. Fegley, Jr., Vertical Distribution of Disequilibrium Species in the Atmosphere of Jupiter. *Space Sci. Revs.* **39**, 163 (1984).
75. J.S. Lewis, The Origin and Evolution of Uranus and Neptune. In: *Uranus and Neptune* (J.T. Bergstralh, ed.), Jet Propulsion Laboratory, Pasadena, California, 1-22 (1984).

76. L.P. Cox and J.S. Lewis, Further Numerical Simulation of the Final Stages of Terrestrial Planet Formation. Submitted (1984).
77. J.S. Lewis and C.P. Meinel, Carbonyls: Shortcut from Extraterrestrial Ores to Finished Products. In: *Lunar Bases and Space Activities in the 21st Century*. NASA Johnson Space Center, 126 (1984).
78. H. Reeves, *Atoms of Silence: An Exploration of Cosmic Evolution*. Translated from the French by R.A. Lewis and J.S. Lewis, M.I.T. Press, Cambridge, MA, 244 pp. (1984).
79. G.H. Watkins and J.S. Lewis, Evolution of the Atmosphere of Mars as the Result of Asteroidal and Cometary Impacts (Abstract). In: *Workshop on the Evolution of the Martian Atmosphere* (M. Carr, P. James, C. Leovy and R. Pepin, eds.), LPI Tech. Rept. 86-07, Lunar and Planetary Institute, Houston, 46 (1986).
80. J.S. Lewis and R.A. Lewis, *Space Resources: Breaking the Bonds of Earth*. 407 pp. Columbia University Press (1987).
81. T.D. Jones and J.S. Lewis, Estimated Impact Shock Production of N₂ and Organic Compounds on Early Titan. *Icarus* **72**, 381 (1987).
82. D.H. Grinspoon and J.S. Lewis, Deuterium Fractionation in the Pre-Solar Nebula: Kinetic Limitations on Surface Catalysis. *Icarus* **72**, 430 (1987).
83. J.S. Lewis, Summary of the Conference: Extraterrestrial Resources. In: *Space Manufacturing* **6**, AIAA, Washington, D.C., 18 (1987).
84. J.S. Lewis, Origin and Composition of Mercury. In: *Mercury* (F. Vilas, C.R. Chapman and M. Matthews, eds.), Univ. of Arizona Press, Tucson, 651 (1988).
85. J.S. Lewis, The History of Mars. In: *The NASA Mars Conference* (D.B. Reiber, ed.), *Amer. Astronaut. Soc. Sci. and Technol. Series* **71**, 23-41 (1988).
86. D.H. Grinspoon and J.S. Lewis, Cometary Water on Venus: Implications of Stochastic Impacts. *Icarus* **74**, 21 (1988).
87. J.S. Lewis, T.D. Jones and W.H. Farrand, Carbonyl Extraction of Lunar and Asteroidal Metals. In: *Engineering, Construction and Operations in Space* (S.W. Johnson and J.P. Wetzel, eds.), Amer. Soc. Civil Engineers, N.Y., 111 (1988).
88. J.S. Lewis, Abundances in Planetary Atmospheres. In: *Cosmic Abundances of Matter* (C.J. Waddington, ed.) Amer. Inst. Phys., 17-37 (1989).
89. J.S. Lewis, Summary of the Conference: Nonterrestrial Resources. In: *Space Manufacturing* **7**, 5-10 (1989).

90. J.S. Lewis, Major Issues in Planetary System Formation: Cosmochemistry. In: *The Formation and Evolution of Planetary Systems* (H.A. Weaver and L. Danly, eds.) Cambridge University Press, 309-314 (1989).
91. S. Engel, J.I. Lunine and J.S. Lewis, Solar Nebula Origin for Volatiles in Comet Halley. *Icarus* **85**, 380 (1990).
92. T.D. Jones, L.A. Lebofsky, J.S. Lewis and M.S. Marley, The Composition and Origin of the C, P and D Asteroids: Water as a Tracer of Thermal Evolution in the Outer Belt. *Icarus* **88**, 172-192 (1990).
93. J.S. Lewis, Lunar, Martian and Asteroidal Resources: Programmatic Considerations. In: *Proceedings of the 1989 Annual Invitational Symposium on Space Mining and Manufacturing, UA/NASA Space Engineering Research Center*, 1-10 (1990).
94. J.S. Lewis and D.H. Grinspoon, Vertical Distribution of Water in the Atmosphere of Venus: A Simple Thermochemical Explanation. *Science* **249**, 1273-1275 (1990).
95. J.S. Lewis, The Origin of the Solar System. In: *The Universe and its Origins* (S.F. Singer, ed.), Paragon House, New York, 113 (1990).
96. J.S. Lewis, K. Ramohalli and T. Triffet, Extraterrestrial Resource Utilization for Economy in Space Missions. *International Astronautical Federation, IAA* **90**-604 (1990).
97. J.S. Kargel, S.K. Croft, J.I. Lunine and J.S. Lewis, Rheological Properties of Ammonia-Water Liquids and Crystal-Liquid Slurries: Planetological Applications. *Icarus* **89**, 93-112 (1991).
98. J.S. Lewis, Extraterrestrial Sources of ^3He for Fusion Power. *Space Power* **10** 363-372 (1991).
99. J.S. Lewis and M. Hutson, Chemistry of the Solar Nebula. In: *Chemistry in Space* (J.M. Greenberg and V. Pirronello, eds.), Kluwer, Boston, 321-338 (1991).
100. J.S. Lewis, Non-Terrestrial Resources of Economic Importance to Earth. *International Astronautical Federation IAA* **91**-656, (1991).
101. D.L. Hoogenboom, J.S. Kargel, J.P. Ganasan and J.S. Lewis, The magnesium sulfate-water system at pressures to 4 kilobars. *Lunar Planet. Sci.* **XXII**, 581-582 (1991).
102. J.S. Lewis, Summary of the Conference: Nonterrestrial Resources. In: *Space Manufacturing* **8**, 19-22 (1991).
103. J.S. Lewis, Construction Materials for an SPS Constellation in Highly Eccentric Earth Orbit. *Space Power* **10**, 353-362 (1991).

104. J.S. Lewis, Asteroid Resources. In: *Space Resources*, **Vol. 3: Materials**, M.F. McKay, D.S. McKay and M.B. Duke, eds. NASA SP-509, 59-78 (1992).
105. V.R. Baker, G. Komatsu, T.J. Parker, V.C. Gulick, J.S. Kargel and J.S. Lewis, Channels and Valleys on Venus: Preliminary Analysis of Magellan Data. *J. Geophys. Res.* **97**, 13421-13444 (1992).
106. T.D. Swindle, J.S. Lewis and L.A. McFadden, The Case for Planetary Sample Return Missions, 4: Near-Earth Asteroids and the History of Planetary Formation. *EOS* **72**, 473-480 (1992) [also in *Earth Space* **4**, No. 6, 11-14 (1992)].
107. J.S. Lewis, Processing Non-Terrestrial Materials. *SME Transactions* **294**, 1864-1868 (1993).
108. H. Hartman, M.A. Sweeney, M.A. Kropp, and J.S. Lewis, Carbonaceous Chondrites and the Origin of Life. *Origins of Life* **23**, 221-227 (1993).
109. J.S. Kargel and J.S. Lewis, Composition, Periodic Element Properties and the Composition and Early Evolution of Earth. *Icarus* **105**, 1-25 (1993).
110. J.S. Lewis, M.S. Matthews and M. Guerrieri, eds., *Resources of Near-Earth Space*, Univ. of Arizona Press, Tucson. 977 pp. (1993).
111. J.S. Lewis, D.S. McKay and B.C. Clark, Using Resources from Near-Earth Space. In: *Resources of Near-Earth Space* (J.S. Lewis, M.S. Matthews and M. Guerrieri, eds.), Univ. of Arizona Press, Tucson. 3-14 (1993).
112. J.S. Lewis and M.L. Hutson, Asteroidal Resource Opportunities Suggested by Meteorite Data. In: *Resources of Near-Earth Space* (J.S. Lewis, M.S. Matthews and M. Guerrieri, eds.), Univ. of Arizona Press, Tucson. 523-542 (1993).
113. J.S. Lewis, Summary of the Conference: Transportation and Materials. In: *Space Manufacturing* **9**, AIAA, Washington D. C., 3-7 (1993)
114. J.S. Lewis, Logistical Implications of Water Extraction from Near-Earth Asteroids. In: *Space Manufacturing* **9**, AIAA, Washington D. C., 71-78 (1993)
115. J.S. Lewis, The Platinum Apples of the Asteroids, *Nature* **372**, 499 (1994).
116. J.S. Lewis, Planetary Resources for Extraterrestrial Technology. *Quart. J. Roy. Astron. Soc.* **36**, 445-448 (1995).
117. J.S. Lewis, *Physics and Chemistry of the Solar System*, Academic Press, New York. 538 pp. (1995).

118. J.S. Lewis, Summary of the Conference: Closing Remarks. In: *Space Manufacturing* **10**, AIAA, Washington D. C., 23-24 (1995)
119. J.S. Lewis, Banquet Address: The Solar System's Greatest Resource. In: *Space Manufacturing* **10**, AIAA, Washington D. C., 31-36 (1995).
120. J.S. Lewis, *Rain of Iron and Ice: The Very Real Threat of Comet and Asteroid Bombardment*, Addison-Wesley, Reading, MA. 236 pp. (1996).
121. J. S. Kargel, M.D. Kraft, D. J. Roddy, J. H. Wittke and J. S. Lewis, Impactite melt fragments at Meteor Crater, Arizona: EOS Transactions of the American Geophysical Union 76, p. F337 (1995).
122. J.S. Kargel, P. Coffin, M. Krafft, J.S. Lewis, D.J. Roddy E. M. Shoemaker and J.H. Wittke, Systematic Collection and Analysis of Meteoritic Materials from Meteor Crater, Arizona. Lunar and Planetary Conference XXVII, 645-646 (1996).
123. J.S. Kargel, M. Krafft, J.S. Lewis, D.J. Roddy and J.H. Wittke, Impactite Melt Fragments at Meteor Crater, Arizona. In preparation (1996).
124. K. Ramohalli and J.S. Lewis, A Survey of Technology Advances in In-Situ Resource Utilization for Economical Space Missions. Submitted (1996).
125. J.S. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets*, Addison-Wesley, Reading, MA. 274 pp. (1996).
126. J.S. Lewis, Physical and Chemical Properties of Near-Earth Objects. In: *Planetary Emergencies: The Collision of an Asteroid or Comet with the Earth* (R. Coppola, ed.), Springer-Verlag, New York. In press (1997). (Publication abandoned by Springer, 2001.)
127. J.S. Lewis, Resources of the Asteroids, *J. Brit. Interplanetary Soc.* **50**, 51-58 (1997).
128. J.S. Lewis, *Rain of Iron and Ice: The Very Real Threat of Comet and Asteroid Bombardment. Revised Edition*, Addison-Wesley, Reading, MA. 241 pp. (1997).
129. J.S. Lewis, *Physics and Chemistry of the Solar System. Revised Edition*, Academic Press, New York. 538 pp. (1997).
130. J.S. Lewis, History of Water on Venus: Cratering Evidence. In preparation (1997).
131. J.S. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets. Revised Edition*, Addison-Wesley, Reading, MA. 274 pp. (1997).
132. J.S. Lewis, Physical and Chemical Properties of NEOs, *Proceedings of the Planetary Defense Workshop*, 215, Lawrence Livermore National Laboratories, Livermore CA (1997).

133. J.S. Lewis, Summary of the Conference Sessions: Asteroids and Nonterrestrial Materials. In: *Space Manufacturing* **11**, AIAA, Washington D. C., 19-20 (1997).
134. J.S. Lewis, Banquet Address: Worlds Without End. In: *Space Manufacturing* **11**, AIAA, Washington D. C., 9-16 (1997).
135. K. Ramohalli, T. Triffet, J.S. Lewis, and A. Cutler, Material Processing Requirements for a Lunar-Based Laboratory. In: *A Lunar-Based Analytical Laboratory*, Cyril Ponnampereuma Memorial Volume, A. Deepak Publishing, Hampton, VA (1997).
136. J.S. Lewis, *Bomben aus dem All: Die kosmische Bedrohung*. Birkhäuser Verlag, Basel. 311 pp. (1997). (Translated from English to German by Hilmar Dürbeck.)
137. J.S. Lewis, Venus and Earth: Another Dynamical Connection? *Astron. Geophys.* 39, 4.8 (1998).
138. J.S. Lewis, *Worlds without End: The Exploration of Planets Known and Unknown*. Perseus Books, 236 pp. (1998).
139. J.S. Lewis, *Unbegrenzte Zukunft: Reichtümer aus dem Universum*. Bettendorf, Munich. 317 pp. (1998). (Translated from English to German by Karl-Heinz Ebnet.)
140. J.S. Lewis and J. Kargel, Condensation-Accretion Models for the Terrestrial Planet Region. In preparation (1998).
141. J.S. Lewis, Mining the Sky: Resources of Asteroids. In: *Elements of Change 1998*, S.J. Hassol and J. Katzenberger, eds., Aspen Global Change Institute, 107-110 (1998).
142. J.S. Lewis, *Comet and Asteroid Impacts: Quantitative Modeling of Hazards on a Populated Earth*. Academic Press, New York. 200 pp. (1999).
143. J.S. Lewis, Tapping the Waters of Space. *Scientific American Presents: The Future of Space Exploration*, 100-103 (1999).
144. J.S. Lewis, Volatility of Compounds of Iron, Aluminum and Phosphorus at the Surface of Venus. In preparation (1999).
145. J.S. Lewis, *Worlds without End: The Exploration of Planets Known and Unknown. Revised Edition*. Perseus Books, 240 pp. (1999).
146. J.S. Lewis, Space Resource Occurrence and Uses. *Encyclopedia of Space Science and Technology*, J. Wiley, (2000).
147. J.S. Lewis, Asteroidal and Cometary Sulfur Infall: Atmospheric Deposition Profiles and Climatological Effects. In preparation (2000).

148. J.S. Lewis, Asteroid Resources, Exploitation, and Property and Mineral Rights. In: *The High Frontier. 20th Anniversary Edition*, Space Studies Institute, pp. 137-149 (2000).
149. J.S. Lewis, *Hui Xing Zhuang Di Qiu*, The Journalist, Taipei, Taiwan. 381 pp.. (Chinese translation of the revised and updated edition of *Rain of Iron and Ice*) (2000).
150. J.S. Lewis, Cosmic Dust-Bunnies. In: *The Book of the Cosmos*, D.R. Danielson ed., Perseus, pp. 510-515 (2000).
151. D. Sears, C.C. Allen, D. Britt, D. Brownlee, A. Cheng, C.R. Chapman, B.C. Clark, I.A. Franchi, H. Kocham, J.S. Lewis, M.M. Lindstrom, and C. Pieters, Near-Earth Asteroid Sample Return Missions. *LPSC*, (2001).
152. J.S. Lewis, Solar System, General. In: *Encyclopedia of Physical Science and Technology*. Academic Press (2001).
153. M. Hoffert, G. Benford, H.J. Herzog, J.W. Katzenberger, H.S. Kheshgi, K.S. Lackner, J.S. Lewis, W. Manheimer, J.C. Mankins, G.U. Marland, M.E. Mauel, L.J. Perkins, M.E. Schlesinger, T. Volk, and T.M.L. Wigley, Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet. *Science* **298**, 981-987 (2002).
154. B.O'Neill, A Grüber, N. Nakicenovic, M. Obersteiner, K. Riahi, L. Schrattonhotzer, F. Toth, R.D. Wilson, R. Krakowski, R. Swart, J.R. Moreira, R. Morita, H. Pitcher, H.-H. Rogner, M.I. Hoffert, K. Caldeira, G. Benford, T. Volk, D.R. Criswell, C. Green, H. Herzog, A.K. Jain, H.S. Kheshgi, K.S. Lackner, J.S. Lewis, H.D. Lightfoot, W. Manheimer, L.J. Perkins, M.E. Schlesinger, and T.M.L. Wigley, Planning for Future Energy Resources. *Science* **300**, 581-584 (2003).
155. J.S. Lewis, Space Resources, Occurrence and Uses. In: *Encyclopedia of Space Science and Technology*, H. Mark, M. Silvera, M. I. Yarymovych and M. Salkin, eds., 598-631 J. Wiley Interscience (2004).
156. J.S. Lewis, *Physics and Chemistry of the Solar System. Second Edition*, Academic Press, New York. 655 pp. (2004).
157. J.S. Lewis and C.F. Lewis, A Proposed International Legal Regime for the Era of Private Commercial Utilization of Space. *The George Washington International Law Review* **37**, 745-767 (2005).
158. J.S. Lewis, *The Rest of All Possible Worlds*. In preparation (2006).
159. J.S. Lewis, Chemical Diversity and Abundances across the Solar System. In: *Chemical Evolution across Space and Time*. L. Zaikowski and J. M. Friedrich, eds., American Chemical Society Symposium Series **981**, 130-140 (2007).

160. J.S. Lewis, Building the Moon Base: Living off the Land. In: *Space Science, Environmental Ethics, and Policy*, in press (available as conference video) (2008).
161. J.S. Lewis, The Road to the Asteroids. In: *Asteroid Resources*, R. Tumlinson, ed. (2012).
162. J. R. Brophy, L. Friedman, C. Allen, D. Baughman, J. Bellerose, B. Betts, M. Brown, M. W. Busch, J. Casani, M. Coradini, F. Culick, J. Dankanich, P. Dimotakis, M. Elvis, I. Garrick-Bethel, B. Gershman, T. Jones, D. Landau, C. Lewicki, J. S. Lewis, M. Lupisella, P. J. Llanos, D. D. Mazanek, P. Mehrotra, J. Nuth, K. Parkin, N. Strange, G. Singh, M. Tantardini, R. Skweickart, B. Wilcox, C. Williams, W. Williams and D. Yeomans, Returning an Entire Near-Earth Asteroid in Support of Human Exploration Beyond Low-Earth Orbit. *Global Space Exploration Conference*. DOI: 10.13140/2.1.3642.3045 (2012).
163. J.S. Lewis, *Asteroid Mining 101*, DSI Press, 184 pp. (2014).
164. M. Sonter, S. Covey, J. S Lewis, and A. Rao, Mineral Resource Estimation for Asteroid Mining Projects. *Lunar and Planetary Science* 45 (2014).
165. S.D. Covey, J.S. Lewis, P.T. Metzger, D. T. Britt and S. E. Wiggins, Simulating the Surface Morphology of a Carbonaceous Chondrite Asteroid. *ASCE Earth-Space* 3 (2016).
166. P.T. Metzger, D.T. Britt, S.D. Covey, and J.S. Lewis, Results of the 2015 Workshop on Asteroid Simulants. (2016).