

Robert T. Pappalardo

Planetary Science Section
Mail Stop 321-560
Jet Propulsion Laboratory
Pasadena, CA 91109

phone: (818) 354-5837
e-mail: robert.pappalardo@jpl.nasa.gov

website: <http://science.jpl.nasa.gov/people/Pappalardo>

Research Focus

Research focuses on processes that have shaped the icy satellites of the outer solar system, especially Europa and the role of its probable subsurface ocean. Europa research includes understanding the satellite's tectonic structures and the stresses that deform the surface, the possibility that solid-state convection has played an important role in the satellite's history, and implications of the surface geology for lithospheric properties and the existence of a liquid water ocean beneath the icy surface. Additional research interests include the nature, origin, and evolution of bright grooved terrain on Jupiter's moon Ganymede, specifically the style of tectonism and implications for the satellite's geological history; the geological implications of geyser-like activity on Saturn's moon Enceladus; and the processes that shape the surface of Saturn's moon Titan.

Education

Ph.D., Arizona State University, Tempe, AZ; Geology; 1994.

B.A., Cornell University, Ithaca, NY; Geological Sciences; 1986.

Professional Positions

Senior Research Scientist: Jet Propulsion Laboratory, Pasadena, CA; 2008–present.

Principal Scientist & Director's Fellow: Jet Propulsion Laboratory, Pasadena, CA; 2006–2007.

Visiting Faculty Associate: Caltech, Division of Geological and Planetary Sciences, Pasadena, CA; 2007–2011.

Assistant Professor Adjoint and Visiting Research Faculty: University of Colorado, Department of Geological Sciences and Laboratory for Atmospheric and Planetary Sciences, Boulder, CO; 2006–2010.

Visiting Faculty: Brown University, Department of Geological Sciences, Providence, RI; 2002–2007.

Assistant Professor: University of Colorado, Astrophysical and Planetary Sciences Department & Laboratory for Atmospheric and Planetary Sciences, Boulder, CO; 2001–2006.

Postdoctoral Research Associate: Brown University, Department of Geological Sciences, Providence, RI; 1995–2001. Dr. James W. Head, research supervisor.

Postdoctoral Research Associate: Arizona State University, Department of Geology, Tempe, AZ; 1994–1995. Dr. Ronald Greeley, research supervisor.

Spacecraft Mission and Pre-Project Involvement

Study Scientist for Europa mission options, Apr. 2011–present.

Scientific oversight of the JPL-APL technical team for definition of a reduced scope Flagship-class mission to Europa.

Chair, Europa Science Definition Team, Apr. 2011–May 2012.

Chair of Science Definition Team to define a reduced scope mission to Jupiter's moon Europa.

Pre-Project Scientist for Jupiter Europa Orbiter, Feb. 2009–Mar. 2011.

Responsible for the scientific integrity and overall scientific success of the Europa Pre-Project; represent the science community to the Pre-Project and to NASA; and serve as scientific spokesperson for the Pre-Project.

Project Scientist for Cassini Equinox Mission (Cassini Extended Mission), July, 2008–Mar. 2010.

Responsible for the scientific integrity and overall scientific success of the Cassini Project; represent the Scientific Investigators of the mission to the Project and to NASA; and serve as scientific spokesperson for the Project.

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Study Scientist for Jupiter Europa Orbiter, 2008–Nov. 2010.

Scientific liaison between the international Joint Jupiter Science Definition Team and the US-based technical team, to define a Flagship-class mission to Europa and the Jupiter system.

Europa Flagship Science Definition Team Co-Chair, 2007.

Co-chair of Science Definition Team to define a Flagship-class mission to Jupiter's moon Europa.

Jupiter Icy Moons Orbiter Science Definition Team; Mar. 2003–Mar. 2004.

Member of advisory team to study the science requirements for a NASA mission to orbit successively the icy Galilean satellites of Jupiter.

Europa Radar Sounder Instrument Definition Team, 1998–1999.

Member of NASA-sponsored consortium to develop a radar sounder instrument for the Europa Orbiter mission, with the goal of mapping subsurface liquid water within Europa.

Europa Orbiter Science Definition Team; 1998–1999.

Member of advisory team to study the science requirements for the planned NASA/JPL mission to orbit Jupiter's satellite Europa, to test whether the satellite has a subsurface ocean.

Affiliate Member, Galileo Solid State Imaging Team, Affiliate member of the Galileo camera team with responsibilities for planning and analyzing images of Jupiter's moons Europa and Ganymede, June 1994–May 2001.

Professional Service

Committee Member, Division for Planetary Sciences (DPS) of the American Astronomical Society (AAS), Oct. 2011–Oct. 2014.

Elected member of the Committee of the DPS, which leads and manages the affairs of the DPS.

Member, Space Studies Board of the National Academy of Sciences, July 2008–June 2014.

Member of oversight board that serves as the focal point within the National Academies for activities on space research, and which provides an independent forum for information and advice on all aspects of space science and applications.

Member, Local Organizing Committee, Workshop on the Habitability of Icy Worlds, Feb. 2014.

Local Organizing Committee of a workshop on the potential habitability of icy worlds.

Member, Senior Research Scientist Council, Jet Propulsion Laboratory, April 2011–present. Member of council responsible for representing the interest of the science and technology community at JPL to management and undertaking tasks of importance to the research community.

Member, Scientific Organizing Committee, Ganymede Lander: Scientific goals and experiments, Mar. 2013.

Scientific Organizing Committee of a workshop on possible Ganymede lander science.

Participant, Outer Planets Assessment Group, Jan. 2005–present.

Member of NASA's community-based forum designed to provide science input for planning and prioritizing outer planet exploration activities.

Co-Chair, National Research Council's Committee on the Origins and Evolution of Life (COEL), July 2008–June 2011.

Co-chair of NRC committee which organizes and provides oversight of studies on research opportunities and programs on the origin and evolution of life in the universe, including NASA's "astrobiology" program.

Coordinator, Outer Planets Colloquium Series, 2008–2011. Coordinator of a JPL-NASA speaker series which facilitates colloquium visits on outer planets topics to research institutions across the US.

Session Co-convenor, American Geophysical Union Fall Meeting, 2010.

Co-organizer of conference sessions on "Icy Ocean Worlds."

Scientific Organizing Committee, Galileo's Medicean Moons: Their Impact on 400 Years of Discovery, IAU Symposium 269; Jan. 2010. Scientific organizing committee for symposium to recognize the 400th anniversary of the discovery of the Galilean satellites.

Session Co-convenor, American Geophysical Union Fall Meeting, 2009.

Co-organizer of conference sessions on "The Galilean Satellites: 400 Years of Discovery."

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Session Co-convenor, American Geophysical Union Spring Meeting, 2009.

Co-organizer of conference sessions on Enceladus.

Member, Lunar and Planetary Institute Science Council, Apr. 2007-2009.

Member of scientific board of directors for the Lunar and Planetary Institute, Houston, TX.

Jovian Planet Systems and Titan Sessions Co-convenor, American Geophysical Union Fall Meeting, 2008.

Co-organizer of conference sessions on Jupiter science and exploration.

Co-organizer, Science of Solar System Ices Workshop, May 2008.

Co-organizer of workshop on the composition, physical properties, and geophysics pertinent to solar system ices.

Session Co-convenor, American Geophysical Union Fall Meeting, 2007.

Co-organizer of conference sessions on Europa science and exploration.

Astrobiology Science Conference (AbSciCon) 2008, Apr. 2008. Member, Steering Committee.

Discovery and Scout Mission Capabilities Expansion Program Review Panel, Feb. 2008.

Member of NASA peer review panel.

Cassini Data Analysis Review Panel, Sept. 2007.

Member of NASA peer review panel.

Ices, Oceans, and Fire: Satellites of the Outer Solar System, Aug. 2007. Member, Scientific Organizing Committee.

Guest Editor, Journal of Structural Geology, Jun. 2004-Dec. 2006.

Guest editor for Special Issue on Faulting and Fault-Related Processes on the Planets and Satellites.

Jupiter/Europa International Working Group, June 2005-Sept. 2006.

Member of international committee to promote cooperation between NASA and ESA on future missions to Europa and the Jupiter system.

Session Co-convenor, American Geophysical Union Fall Meeting, 2006.

Co-organizer of conference sessions on ice properties relevant to planetary geophysics.

Division for Planetary Sciences 2006 Meeting, Oct. 2006. Member, Scientific Program Committee.

Belton Symposium: Journey Through the Solar System, Nov. 2006. Member, Scientific Organizing Committee.

Member, NASA Solar System Exploration Strategic Roadmap Committee, Feb. 2005 - May 2006.

Member of NASA committee to identify key objectives and implementation for solar system exploration as corresponding to NASA's guiding national objectives.

Member, NASA Solar System Exploration Subcommittee (SSES), Feb. 2004 - May. 2005.

Member of NASA committee to provide advice and recommendations to NASA's Space Science Advisory Committee on all aspects of solar system exploration.

Associate Editor, Geophysical Research Letters, Feb. 2002-Dec. 2004.

Associate editor for a special issue in the area of planetary tectonics.

Local Scientific Organizing Committee, NASA Astrobiology Institute General Meeting 2005; May 2004-April 2005. Local organizing committee for planetary geology presentations.

Division for Planetary Sciences 2003 Meeting, Oct. 2003. Member, Scientific Program Committee.

Member, National Research Council's Committee on Planetary and Lunar Exploration (COMPLEX), July 2000 - June 2003.

Member of committee advising the Space Studies Board of the National Academy of Sciences on planetary studies that can be conducted from space and supporting ground-based activities.

Planetary Geology and Geophysics Review Panel, July 2002.

Member of NASA peer review panel.

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Steering Group Member and Vice Chair of Large Satellites Panel, Solar System Exploration Strategy (“Planetary Decadal Survey”) Committee, May 2001 - July 2002.

Vice-chair and steering group representative of National Research Council panel advising NASA and the Space Studies Board of the National Academy of Sciences on goals and priorities for planetary exploration for the decade 2003-2013.

Member, Task Group to Assess Mars Science and Mission Priorities, Jan. 2001 - Oct. 2001.

Member of National Research Council committee to assess NASA's Mars Exploration Program.

Division for Planetary Sciences 2001 Meeting, Nov. 2001. Member, Scientific Program Committee.

Jupiter Conference, June 2001, Boulder CO. Member, Scientific and Local Organizing Committees.

Session Co-convenor, American Geophysical Union Fall Meeting, 1998, 2000.

Co-organizer of conference sessions on Galileo spacecraft results at Jupiter and its satellites.

Group Chair, Jupiter System Data Analysis Review Panel, 1999.

Satellites group chair for NASA's Jupiter System Data Analysis Program peer review panel.

Member, Campaign Strategy Working Group for Prebiotic Chemistry in the Outer Solar System, Sept.

1998-Oct. 1999. Member of committee to formulate recommendations to the NASA Solar System Exploration Subcommittee and NASA Headquarters as to the objectives and priorities of NASA missions to follow the Cassini/Huygens and Europa Orbiter missions.

Workshop on Remote Sensing of Planetary Ices: Earth and Other Solid Bodies, June 1997. Member, Scientific Organizing Committee.

Honors and Awards

NASA Exceptional Service Medal, for dedicated scientific and strategic leadership of the Cassini Equinox/Solstice Missions and the Europa Jupiter System flagship mission concept, 2011.

NASA Group Achievement Award, for outstanding achievements in finalizing the pre-integrated science events and segmenting the Cassini Solstice Mission tour into science discipline components, 2011.

JPL Team Award, for helping to organize the workshop on Science of Solar System Ices, 2008.

JPL Mariner Award, for science leadership of the 2007 Europa Explorer study, 2008.

NASA Tech Briefs Award, High-Pressure Reaction Vessel for Studying Biogeochemical Reactions Under Simulated Europa Ocean Conditions, 2008; with Principal Investigator Xenia Amashukeli. Presented by NASA for outstanding scientific or technical contributions sponsored, adopted, supported, or used by NASA which are significant to aeronautics and space activities.

Applied Physics Laboratory (Johns Hopkins University) Outstanding Paper in a Classified or Unclassified Publication, for the *Science* article *Folds on Europa: Implications for Crustal Cycling and Accommodation of Extension*, with coauthor L. M. Prockter, Sept. 2001.

Galileo Imaging Team Superior Performance Award, for design, playback, analysis, and interpretation of solid-state imaging camera data from the Galileo Ganymede 1 encounter, Jan. 1997.

Stephen E. Dworkin Planetary Geoscience Student Paper Award, Honorable Mention, 25th Lunar and Planetary Science Conference, Houston, Texas, Oct. 1994.

William and Katherine Snee Award for Academic Excellence, Cornell University, May 1985.

Professional Societies and Organizations

International Academy of Astronautics (IAA), Corresponding Member, Basic Sciences Section, 2013–present.

Committee on Space Research (COSPAR), Associate Member, 2009–present.

Division for Planetary Sciences (DPS) of the American Astronomical Society (AAS), Associate Member, 1996–present.

American Geophysical Union (AGU), Member, 1989–present.

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Active Research Projects

- Co-Investigator: A Global Geologic Map of Enceladus**, NASA Planetary Geology and Geophysics Program; 2014-2018; with Principal Investigator G. Wesley Patterson and Co-Investigators Geoffrey Collins and Tammy Becker.
- Co-Investigator: Strike-slip faulting processes on Ganymede: Morphological inferences and failure mechanics**, NASA Outer Planets Research Program; 2013-2016; with Principal Investigator Bridget Smith-Konter and Co-Investigator Geoffrey Collins.
- Collaborator: Elemental Sulfur Deposits as Astrobiological Targets: Formation and Preservation of S in Low-Temperature Sulfide Springs Relevant to Mars and Europa**, NASA Exobiology Program; 2013–2016; with PI Alexis Templeton and Co-Is John Spear and Steven Grasby.
- Co-Investigator: Three-dimensional Semi-analytic Viscoelastic Earthquake Modeling as Applied to Faulting Processes on Enceladus and Europa**, NASA Outer Planets Research Program; 2008-2012; with Principal Investigator Bridget Smith-Konter.
- Principal Investigator: Fracture Formation on Europa and Other Icy Satellites**, NASA Outer Planets Research Program; 2006 – 2009.
- Principal Investigator: Icy Satellite Geology: Computer Assisted Stratigraphic Sorting and Exploring a Europa Arctic Analog**, NASA Planetary Geology and Geophysics Program; 2007 – 2008.
- Co-Investigator: Geomicrobiology of a Unique Ice-Sulfur Spring Ecosystem in the High Canadian Arctic: A Testbed for Europa Exploration**, NASA Astrobiology Institute's 2007 Director's Discretionary Fund; 2007 – 2008; with Principal Investigator Alexis Templeton.
- Co-Investigator: Wide-Band Radiation Tolerant Radar Sounder Transmitter Development**, NASA Planetary Instrument Definition and Development Program; 2007 – 2009; with Principal Investigator Ali Safaeinili.
- Co-Investigator: Strain on the Saturnian Satellites**, NASA Cassini Data Analysis Program; 2007 – 2009; with Principal Investigator Geoff Collins.
- Co-Investigator: Identification of recent cryosphere activity in hyperspectral imagery with an emphasis on methods for Europa**, Jet Propulsion Laboratory Director's Research and Development Fund, with PI Rebecca Castaño, 2007 – 2009.
- Principal Investigator: Causes and Consequences of Faulting on Europa and Other Icy Satellites**, NASA Planetary Geology and Geophysics Program; 2004 – 2007; with Co-Investigators Louise Prockter, Geoffrey Collins, and Roger Buck.
- Principal Investigator: Characteristics and Consequences of Faulting on Ganymede and Europa**, NASA Planetary Geology and Geophysics Program; 2002 – 2004; with Co-Investigators Francis Nimmo and Paul Schenk.
- Principal Investigator: Astrobiological and Geological Implications of Convective Transport in Icy Outer Planet Satellites**, NASA Exobiology Program; 2002 – 2005; with Co-Investigator Shijie Zhong.
- Collaborator: Physical Models of Tectonic Resurfacing on Ganymede**, NASA Outer Planets Research Program; 2005 – 2008; with Principal Investigator Darrell Sims.
- Co-Investigator: Ganymede: Synthesis of Observations on Processes and History for the Type Locality of an Icy Satellite**, NASA Planetary Geology and Geophysics Program; 2005 – 2008; with Principal Investigator James Head.
- Co-Investigator: Geological Mapping of Ganymede: A Post-Galileo View**, NASA Planetary Geology and Geophysics Program; 2002 – 2005; with Principal Investigator James Head.
- Co-Investigator: University of Colorado Center for Astrobiology**, with PI Bruce Jakosky. Sept. 2003 – May 2006.
- Principal Investigator and Research Supervisor: Astrobiological and Geological Implications of Diapiric Transport within Ganymede and Europa**, Graduate Student Research Program; 2001 – 2004; for Graduate Student Amy Barr.

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Principal Investigator: Diapirism and Solid-State Convection on Europa, NASA Jupiter System Data Analysis Program; 1998 – 2001; with Co-Investigator David Goldsby and Collaborator Christophe Sotin.

Principal Investigator: Origin, Structure, and Evolution of Grooved Terrain on Ganymede and Comparison to Europa, NASA Jupiter System Data Analysis Program; 1998 – 2001.

Post-doc, Graduate Student, and Undergraduate Student Mentoring

D. Alex Patthoff, Post-doctoral Researcher (NPP): Analysis of ridge and trough terrains on the outer icy satellites: A comparative planetology approach.

Fiona Seifert, Graduate Researcher, University of Michigan, Ann Arbor, MI.

Heather Chilton, Year-Round Undergraduate Researcher, now a graduate student in Environmental Science & Technology, Georgia Institute of Technology.

Erin Leonard, Undergraduate Researcher, now a graduate student in Earth, Planetary, and Space Sciences at the University of California, Los Angeles.

Damhnait Gleeson, Post-doctoral Researcher, Caltech/JPL, 2010–2011. Now a researcher with the European Space Agency (ESA) at Centro de Astrobiología (CAB), Madrid, Spain.

Emma Crow-Willard, Academic Part-time (APX) undergraduate researcher, Occidental College, 2008–2011, Pasadena, CA. Currently at Geoscience Support Services, Inc., Laverne, CA.

Flora Paganelli, Post-doctoral Researcher, UCLA/JPL, 2009–2010. Now a post-doctoral researcher at the University of Hawaii at Manoa, Honolulu, HI.

Giuseppe Mitri, Post-doctoral Researcher, Caltech/JPL, 2008–2010. Now a researcher at Istituto di Astrofisica e Planetologia Spaziali, Rome, Italy.

Damhnait Gleeson, Graduate Student, Ph.D. in Geological Sciences, University of Colorado, 2004-2009. Now a postdoctoral researcher at JPL.

Zane Selvans (formerly Zane Crawford), Graduate Student, Ph.D. candidate in Geological Sciences, University of Colorado, 2003-2009. Now self-employed.

Bridget Smith-Konter, Post-doctoral Researcher, Caltech/JPL, 2007. Now an Associate Professor, Department of Geology and Geophysics, University of Hawaii at Manoa.

Amy Barr, Graduate Student, Ph.D. in Geophysics, University of Colorado, 2001-2005. Most recently a faculty member at Brown University, Providence, RI.

McCall Mullen, Undergraduate Student, B.S. in Astrophysical and Planetary Sciences, University of Colorado, 2004-2006. Now a graduate student at Brown University, Providence, RI.

Michelle Stempel (now Michelle Selvans), Undergraduate Student, B.S. in Physics, University of Colorado, 2001-2004. Now a graduate student at Caltech, Pasadena, CA.

G. Wesley Patterson, Undergraduate Student, B.S. in Astrophysical and Planetary Sciences, University of Colorado, 2001-2003. Now a Postdoctoral Researcher at the Johns Hopkins Applied Physics Laboratory, Laurel, MD.

Courses Taught

Planetary Surfaces and Interiors, University of Colorado, ~11-15 graduate students, Fall 2001, 2003, 2005.

Extraterrestrial Life, University of Colorado, 70 upper-level undergraduate students, Spring 2002, Fall 2002, and Spring 2005.

General Astronomy 1 (The Solar System), University of Colorado, ~230 undergraduate students, Spring and Fall 2004.

Planetary Science Seminar, Co-instructor, University of Colorado, ~15-17 graduate students, Fall 2004 and Spring 2005.

Europa, University of Colorado, 5 graduate and undergraduate students, Spring 2003.

Introductory Astronomy, Dowling College, 25 undergraduate students, Summer 1989.

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Invited Scientific Presentations

- SPIE Optics + Photonics Conference, Symposium-Wide Plenary Session**, San Diego, CA, Aug. 2014: *The Europa Clipper Mission Concept: Exploring a Potentially Habitable World.*
- Lamont-Doherty Geophysical Observatory**, Palisades, NY, Apr. 2014: *The Geology of Europa: Exploring a Potentially Habitable Ocean World.*
- University of Nebraska, Lincoln, Shapley Lecture**, Lincoln, NE, Apr. 2014: *Ices and Oceans in the Outer Solar System.*
- Workshop on the Habitability of Icy Worlds**, Pasadena, CA, Feb. 2014: *Europa.*
- Geological Society of America (GSA) Annual Meeting**, Planetary Geology Division Pardee Symposium, Denver, CO, Oct. 2013: *Seeking Europa's Ocean.*
- Geological Society of America (GSA) Annual Meeting**, Denver, CO, Oct. 2013: *Science and Reconnaissance from the Europa Clipper Mission Concept.*
- American Association for the Advancement of Science (AAAS) Annual Meeting**, Boston, MA, Feb. 2013: *The Icy But Warm Moons of Jupiter.*
- University of California, Los Angeles**, Los Angeles, CA; Nov. 2012: *Ridge and Trough Terrains on Icy Satellites and Exploring Europa.*
- Brown University**, Providence, RI; Oct. 2012: *Ridge and Trough Terrains on Icy Satellites and Exploring Europa..*
- Boston University**, Boston, MA, Sept. 2012: *Ridge and Trough Terrains on Icy Satellites.*
- Massachusetts Institute of Technology**, Cambridge, MA, May 2012: *Pragmatic Mission Options for Exploring Europa.*
- Boston University**, Boston, MA, May 2011: *Seeking Europa's Ocean.*
- Washington University**, St. Louis, MO, Apr. 2011: *Seeking Europa's Ocean.*
- Goddard Space Flight Center**, Greenbelt, MD, Apr. 2011: *Seeking Europa's Ocean.*
- University of Michigan**, Ann Arbor, MI, Apr. 2011: *Seeking Europa's Ocean.*
- Paris Observatory**, Paris, France, Feb. 2011: *Ridge and Trough Terrains on Outer Planet Satellites.*
- Dartmouth College**, Hanover, NH, Oct. 2010: *Ices and Oceans in the Outer Solar System: Implications for Habitability.*
- Southwest Research Institute**, Boulder, CO, Apr. 2010: *Titan: An Exogenic World?*
- University of Colorado**, Boulder, CO, Apr. 2010: *Exploring the Habitability of Icy Worlds: The Europa Jupiter System Mission.*
- SETI Institute**, Mountain View, CA, Mar. 2010: *Exploring the Habitability of Icy Worlds: The Europa Jupiter System Mission.*
- Keck Institute for Space Studies, Challenging the Paradigm: The Legacy of Galileo**, California Institute of Technology, Pasadena, CA, Nov. 2009: *What We Don't Know About Europa.*
- IAU Symposium 269, Galileo's Medicean Moons: Their Impact on 400 Years of Discovery**, Padua, Italy, Jan. 2010: *Past and Future Exploration of Europa.*
- Space Telescope Science Institute Symposium, The Search for Life in the Universe**, Baltimore, MD, May 2009: *Exploring the Habitability of Icy Worlds: The Europa Jupiter System Mission.*
- University of California, Los Angeles**, Westwood, CA, Mar. 2009: *Exploring the Habitability of Icy Worlds: The Europa Jupiter System Mission.*
- Westfield State College, Shapley Lecture**, Westfield, MA, Oct. 2007: *On the Habitability of Icy Moons.*
- Arizona State University West, Shapley Lecture**, Phoenix AZ, Oct. 2007: *Exploring Europa's Hidden Ocean.*
- Geological Society of America Conference**, 2007 Annual Meeting, Denver CO, Oct. 2007: *Exploring Europa.*
- University of California, Los Angeles, Earth and Space Sciences Dept.**, Los Angeles, CA, Apr. 2007: *Ices and Oceans in the Outer Solar System.*

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- National Academy of Sciences Sackler Symposium: Evolution and Exploration of Solar Systems**, Irvine, CA, Jan. 2006: *Europa and Oceans in Icy Satellites*.
- Belton Symposium: Journey Through the Solar System**, Tucson, AZ, Nov. 2006: *Ganymede: "What the Hell is Going on There?"*
- Geological Society of America Conference**, 2006 Annual Meeting, Planetary Geology Division Pardee Symposium, Denver CO, Oct. 2006: *Ices and oceans in the outer solar system*.
- Scripps Institution of Oceanography, Institute of Geophysics and Planetary Physics**, La Jolla, CA, Sept. 2006: *The hidden ocean of Europa*.
- European Planetary Science Congress**, Berlin, Germany, Sept. 2006: *Europa: Processes and habitability*.
- Rencontres de Blois XVIII: Planetary Science: Challenges and Discoveries**, Blois, France, June 2006: *Europa*.
- University of California, Los Angeles, Earth and Space Sciences Dept.**, Los Angeles, CA, Jun. 2006: *Reorientation of Mini-Moons: Enceladus and Miranda*.
- University of California, Santa Cruz, Earth Sciences Dept.**, Santa Cruz, CA, Nov. 2005: *Wavy Lineaments on Europa*.
- University of Arkansas, Dept. of Geosciences**, Fayetteville, AR, Apr. 2005: *The hidden ocean of Europa*.
- University of California at Berkeley, Center for Integrative Planetary Studies**, Berkeley, CA, Feb. 2005: *"Wavy" lineaments on Europa*.
- Workshop on the Limits of Organic Life in Planetary Systems**, Washington, DC, May 2004: *Europa's ocean*.
- Stanford University, School of Earth Sciences**, Stanford, CA, May 2004: *Geology of Europa: Where are we now?*
- American Geophysical Union Meeting**, Fall 2003, San Francisco CA: *Icy satellites: Extreme permafrost*.
- Catania Astrophysical Observatory, Università di Catania**, Catania, Sicily, June 2003: *Geology of the Icy Galilean Satellites*.
- Geological Society of America Conference**, 2002 Annual Meeting, Denver CO, Oct. 2002: *Geology of Europa and next steps in its exploration*.
- Physics and Chemistry of Ice Conference**, St. Johns NF, Canada, July 2002: *Ice in the solar system*.
- Ball Aerospace**, Boulder CO, July 2002: *New Frontiers in the solar system: Results of the planetary science decadal survey*.
- American Geophysical Union Meeting**, Fall 2001, San Francisco CA: *Europa: Divining water from surface geology*.
- Jupiter Conference**, Boulder, CO, June 2001: *Overview of Europa's geology: Implications for the ice shell and a sub-ice ocean*.
- Massachusetts Institute of Technology, Ocean Engineering Dept.**, Cambridge MA, April 2001: *Geology of Europa from Galileo imaging: Implications for current activity*.
- International Astronomical Union General Assembly**, Manchester England, Aug. 2000: *Geology and composition of the icy Galilean satellites*.
- University of Washington, Oceanography Dept.**, Seattle, WA, June 2000: *Does Europa have a subsurface ocean? The geological evidence, and the role of ductile ice*.
- University of Colorado, Astrophysical and Planetary Sciences Dept.**, Boulder CO, April 2000: *Europa: Role of the ductile layer*.
- Photolysis and Radiolysis of Outer Solar System Ices Conference**, Applied Physics Laboratory, Laurel MD, March 2000: *The search for Europa's ocean*.
- Wheaton College, Astronomy and Physics Dept.**, Norton, MA, Feb. 2000: *The search for Europa's ocean*.
- American Geophysical Union Meeting**, Spring 1999, Boston MA, June 1999: *Geology of the Galilean satellites of Jupiter*.
- American Geophysical Union Meeting**, Fall 1999, San Francisco CA, Dec. 1999: *Geology of the icy Galilean satellites: A framework for compositional studies*.

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- Rutgers Univ., Institute of Marine and Coastal Sciences**, New Brunswick NJ., Sept. 1999: *Does Europa have a subsurface ocean?*
- University of Arizona, Lunar and Planetary Laboratory**, Tucson AZ, May 1999: *Geology of Europa from Galileo imaging: Role of the ductile layer and Ridge and trough terrain on icy satellites: From Ganymede to Miranda and back.*
- European Geophysical Society Meeting**, 24th General Assembly, The Hague, The Netherlands, April 1999: *Ganymede after Galileo: Grooved, dark, and polar terrains.*
- Western Pacific Geophysics Meeting**, Taipei, Taiwan, July 1998: *The search for a subsurface ocean on Europa.*
- Committee on Space Research (COSPAR)**, 32nd Scientific Assembly, Nagoya, Japan, July 1998: *Geology of Europa from Galileo imaging.*
- Brown University, Geological Sciences Dept.**, Providence, RI, May 1998: *Europa: Recent geological evolution, heat loss mechanisms, and relation to non-synchronous rotation stresses.*
- Massachusetts Institute of Technology, Dept. Earth, Atmospheric and Planetary Sciences**, Cambridge MA, Nov. 1997: *Geology of the Galilean satellites from Galileo imaging.*
- International Astronomical Union General Assembly**, Kyoto, Japan, Aug. 1997: *Geology of Ganymede and Callisto.*
- Division for Planetary Sciences of the American Astronomical Society**, 29th Annual Meeting, Cambridge, MA, July 1997: *Geology of Europa as revealed by Galileo imaging.*
- Workshop on the Remote Sensing of Planetary Ices**, Flagstaff AZ, June 1997: *Ice geology: Ganymede, Callisto, and Europa as revealed by Galileo imaging.*
- American Geophysical Union Meeting**, Spring 1997, Baltimore MD, April 1997: *Geology of Ganymede as revealed by Galileo imaging.*
- University of Colorado, Astrophysical and Planetary Sciences Dept.**, Boulder CO, March 1997: *Ice geology: Europa, Ganymede, and Callisto as revealed by Galileo.*
- Geological Society of America Meeting**, 1996 Annual Meeting, Planetary Geology Division Symposium on Planets as Complex Systems, Denver, CO, Oct. 1996: *Geology of the outer planet satellites.*
- Europa Ocean Conference**, San Juan Capistrano Research Institute CA, Nov. 1996: *A European ocean? The (circumstantial) geological evidence.*
- MIT Autonomous Underwater Vehicles Laboratory**, Cambridge MA, April 1996: *The geology of Jupiter's satellite Europa: Is there an ocean beneath the icy surface?*

Public Lectures, Press Briefings, and Media Appearances

- NASA eClips**, Mar. 2014. Interview on outer solar system science topics for NASA educational videos intended for K-12 students.
- Open University**, Mar. 2013. Interview for a video series on planetary science.
- Nova: Life Beyond Earth**, 2011. Advisor for Public Television program about the search for life in the Solar System and beyond.
- PBS Newshour**, Mar. 2010. Interview for Public Television program about planetary exploration.
- National Geographic Explorer, National Geographic Channel, Journey to an Alien Moon**, Apr. 2010. Interview for television program about Europa exploration.
- Nova: Hunting the Edge of Space – How Telescopes Have Expanded Our View of the Universe**, Apr. 2010. Interview on Cassini results for Public Television program about the history of the telescope.
- SETI: Science and Skepticism, Habitats Not for Humanity**, Apr. 2010. Interview about Europa for podcast on the nature and prevalence of life in the Universe.
- National Geographic Channel, A Traveler's Guide to the Planets: Jupiter**, Feb. 2010. Interview for television program about Jupiter and its moons.
- National Geographic Channel, A Traveler's Guide to the Planets: Saturn**, Feb. 2010. Participation in television program about the Saturn system.

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- BBC Radio: 2010 - *Space Odyssey to Europa***, Feb. 2010. Interview for radio documentary about Europa.
- 365 Days of Astronomy: Saturn's Moon Enceladus – Past, Present, and Future**, Aug. 2009. Interview for podcast about the geology and exploration of Enceladus.
- Naked Science, National Geographic Channel: *Journey to Jupiter***; Mar. 2009. Interview for *National Geographic Channel* television program about Jupiter and its moons.
- von Kármán Lecture**, Nov. 2007, Jet Propulsion Laboratory and Pasadena Community College, Pasadena, CA. Public presentation on *The hidden ocean of Europa: Beneath the frozen surface*.
- The Universe: *Alien Moons***; Oct. 2007. Interview for *History Channel* television program about the solar system's moons.
- Modern Marvels: *Ice***; Feb. 2007. Interview for *History Channel* television program about the nature of ice on Europa.
- Europa: *Mystery of the Ice Moon***; Feb. 2005 - Mar. 2006. Interviews and advising for *Science Channel* television program about the exploration of Europa.
- Planetary Radio**; June 2006. Interview for *Planetary Society* radio program about Europa.
- National Public Radio, *Water - The Marvelous Molecule***; May 2003. Interview for radio program about water in the solar system and the prospects for life within Europa.
- Jupiter Conference**, June 2001, Boulder, CO: Public presentation on *The hidden ocean of Europa*.
- National Public Radio, *DNA Files***, Nov. 2001. Guest and advisor for radio program about the search for extraterrestrial life in the solar system.
- Lowell Lecture Series, Boston Museum of Science**, Apr. 1998, Boston, MA. Public presentation on *Galileo at Jupiter and its moons*.
- Press Briefing: Galileo's Closest Encounter with Europa**, Mar. 1998, Providence, RI. Participant in press briefing describing the highest resolution images obtained by Galileo at Europa.
- Planetary Society Event: Galileo's Year of Discovery**, Dec. 1996, Providence, RI. Public presentation on the Galileo orbiter and probe discoveries at Jupiter.
- Planetary Society Event: Galileo at Jupiter**, Oct. 1996, Tucson, AZ. Public presentation on the Galileo spacecraft's discoveries at Ganymede.
- Press Briefing: Galileo Encounters Ganymede**, July 1996. Participant in press conference describing the first images returned by Galileo from Jupiter orbit.
- The Connection: WBUR Radio, Boston**, June 1996. Guest on radio interview and call-in program, discussing the upcoming Galileo mission at Jupiter.
- The Art Bell Show**, July 1994. Guest on nationwide radio interview and call-in program, discussing contemporary planetary science events, especially the Shoemaker-Levy/9 collision with Jupiter.
- Long Island Cable News Network**, Aug. 1989. Guest on Long-Island, NY cable news interview program discussing the Voyager 2 encounter with Neptune and Triton.

Educational and Community Work

- Lee High School Engineering Project**, Huntsville, AL; 2010-2011.
Advisor to high school engineering magnet class on Europa mission project, as part of NASA-sponsored Innovative Student Project for the Increased Recruitment of Engineering and Science Students (InSPIRESS) project, resulting in class presentation to NASA's Planetary Science Chief.
- University of Hawaii Astrobiology Winter School**; 2005.
Co-instructor for short course on astrobiology targeted to graduate students.
- NASA Astrobiology Institute Insight Course**; 2003.
Co-instructor for short course on planetary science targeted to researchers in biological sciences.
- Denver Museum of Nature and Science**; 2002.
Scientific consultant to planetarium show on the astrobiological potential of Europa.
- Arizona State University Geosciences Alumni Scholarship**; 2001-present.
Member of selection committee for alumni-sponsored scholarship program.
- Ethics in Action**, Tempe, AZ; 1994-1995.
Vice-President of community group concerned with the quality of life in Tempe.

Robert T. Pappalardo

Don't Waste Arizona, Phoenix, AZ; 1993-1994.

Active member of an environmental organization working to bring environmental equity to a minority community affected by a chemical fire.

Arizona Museum of Science and Technology, Phoenix, AZ; 1990-1993.

Demonstrating and explaining exhibits.

Laboratory Coordinator: Cherokee Elementary School, Paradise Valley, AZ; 1991-1992.

Development and teaching science laboratory exercises for school children in grades K-6.

Adjunct Lecturer: Dowling College, Oakdale, NY; 1989.

Teaching of undergraduate course on introductory astronomy.

Science Discovery Center of Tompkins County, Ithaca, NY; 1985-1986.

Design and construction of astronomy display; explaining hands-on exhibits to children.

Vanderbilt Planetarium, Centerport, NY; 1989-1990.

Internship on production, lecturing, and show operation for elementary school, adult, and special-topic planetarium programs. Conducting astronomy classes, lectures, and demonstrations.

Vanderbilt Planetarium, Centerport, NY; 1984.

Volunteer production, lecturing, and show operation for elementary school and adult planetarium programs.

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Crow-Willard, E. N. and R. T. **Pappalardo**. Structural mapping of Enceladus and implications for formation of tectonized regions. *J. Geophys. Res.*, in revision.

Kempf, S., J. Schmidt, T. Brockwell, T. Cravens, L.W. Esposito, K. Fiege, B. Giese, M. M. Hedman, P. Helfenstein, T. A. Hurford, R. Jaumann, G. Jones, S. Kanani, S. W. Kieffer, W. Lewis, B. A. Magee, D. L. Matson, F. Nimmo, R. **Pappalardo**, M. E. Perry, F. Postberg, J. Saur, J. Spencer, C. Sotin, F. Spahn, B. Teolis, G. Tobier, H. Waite, D. T. Young, M. Zolotov. Enceladus as an active body. *Space Sci. Rev.*, in review.

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Moore, J. M., A. D. Howard, P. M. Schenk, W. B. McKinnon, R. T. **Pappalardo**, R. C. Erwing, E. B. Bierhaus, V. J. Bray, and J. R. Spencer, R. P. Binzel, B. Buratti, W. M. Grundy, C. B. Olkin, H. J. Reitsema, D. C. Reuter., S. A. Stern, H. Weaver, L.A. Young, and R. A. Beyer. Geology before Pluto: Pre-encounter considerations. *Icarus*, in press.

***Pappalardo**, R. T., D. Senske, L. Prockter, B. Paczkowski, G. W. Patterson, S. Vance, B. Goldstein, T. Magner, B. Cooke, and the Europa Study Team. The Europa Clipper mission concept to explore Europa and investigate its habitability. *Proceedings of the 46th Lunar and Planetary Symposium, ISAS*, in press.

Prockter, L.M., and R.T. **Pappalardo**. Europa. In *Encyclopedia of the Solar System, 3rd ed.* (T. Spohn, T. V. Johnson, and D. Breuer, eds.), Academic Press, in press.

Tobie, G., N. A. Teanby, A. Coustenis, R. Jaumann, F. Raulin, J. Schmidt, N. Carrasco, A. Coates, D. Cordier, R. De Kok, W. D. Geppert, J.-P. Lebreton, A. Lefevre, T. A. Livengood, K. E. Mandt, G. Mitri, F. Nimmo, C. A. Nixon, L. Norman, R. T. **Pappalardo**, F. Postberg, S. Rodriguez, D. Schulze-Makuch, J. M. Soderblom, A. Solomonidou, K. Stephan, E. R. Stofan, E. P. Turtle, R. J. Wagner, R. A. West, J. H. Westlake. Science goals and mission concept for future exploration of Titan and Enceladus. *Planet. Space Sci.*, in press.

Yin, A. and R. T. **Pappalardo**, Gravitational spreading, bookshelf faulting, and tectonic evolution of the South Polar Terrain of Enceladus. *Icarus*, submitted.

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- Phillips, C. B. and R. T. Pappalardo. The Europa Clipper: A mission concept for exploring Jupiter's ocean world. *Eos*, 95, 165–167, 2014.
- Sims, D., D. Wyrick, D. Ferrill, A. Morris, G. Collins, R. **Pappalardo**, and S. Colton. Physical models of grooved terrain tectonics on Ganymede. *Geophys. Res. Lett.*, 41, doi:10.1002/2014GL060359, 2014.

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- Besserer, J., F. Nimmo, J. H. Roberts, and R. T. **Pappalardo**. Convection-driven compaction as a possible origin of Enceladus's long wavelength topography. *Geophys. Res. Lett.*, doi:10.1002/jgre.20079, 2013.
- Pappalardo**, R. T., S. Vance, F. Bagenal, B. G. Bills, D. L. Blaney, D. D. Blankenship, W. B. Brinckerhoff, J. E. P. Connerney, K. P. Hand, T. M. Hoehler, J. S. Leisner, W. S. Kurth, M. A. McGrath, M. T. Mellon, J. M. Moore, G. W. Patterson, L. M. Prockter, D. A. Senske, B. E. Schmidt, E. L. Shock, D. E. Smith, and K. M. Soderlund. Science potential from a Europa lander. *Astrobiology*, 13, 740–773, 2013.
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- *Rhoden, A. and **Pappalardo**, R. T. *Turning the Tides: Setting Sail with the Europa Clipper*. *Planetary Report*, 33, 8–12, 2013.

2012

- Europa Study Team. *Europa Study 2012 Report*. JPL D-71990, 2012.
- Gleeson, D. F., **Pappalardo**, R. T., M.S. Anderson, S. E. Grasby, R.E. Mielke, K.E. Wright, and A.S. Templeton. Biosignature detection at an Arctic analog to Europa. *Astrobiology*, 12, 1-16, 2012.
- Mandrake, L., U. Rebbapragada, K. L. Wagstaff, D. Thompson, S. Chien, D. Tran, R. T. **Pappalardo**, D. Gleeson, and R. Castaño. Surface sulfur detection via remote sensing and onboard classification. *ACM TIST*, 3, 77, 2012.
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- Clark, K., J. Boldt, R. Greeley, K. Hand, I. Jun, R. Lock, R. **Pappalardo**, T. Van Houten, and T. Yan. Return to Europa: Overview of the Jupiter Europa Orbiter mission. *Adv. Space Res.*, 48, 629–650, 2011.
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- ***Pappalardo**, R. T. Seeking Europa's ocean. In *Galileo's Medicean Moons: Their Impact on 400 Years of Discovery*, Proceedings IAU Symposium No. 269 (C. Barbieri et al., eds.), pp. 101-114, 2010.
- ***Pappalardo**, R. T. What we don't know about Europa. In *Challenging the Paradigm: The Legacy of Galileo* (C. Zuffada et al., eds.), California Institute of Technology, Pasadena, pp. 33–53, 2011.
- Williams, K. E. and R. T. **Pappalardo**. Variability in the small crater population on Callisto. *Icarus*, 215, 253–259, 2011.
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