

**WRITTEN TESTIMONY OF  
MARCIA K. McNUTT, PH.D.  
PRESIDENT AND CEO  
MONTEREY BAY AQUARIUM RESEARCH INSTITUTE  
MOSS LANDING, CALIFORNIA**

**BEFORE THE  
COMMITTEE ON SCIENCE  
U.S. HOUSE OF REPRESENTATIVES**

**JULY 27, 2006**

Good afternoon, Chairman Ehlers, and distinguished members of the Subcommittee on Environment, Technology, and Standards. I am Marcia McNutt, director of the Monterey Bay Aquarium Research Institute (MBARI) in California. MBARI is a small, private, non-profit research laboratory founded by David Packard to serve as a technology incubator for the ocean research community. I am pleased to be here today to provide my views on two of the National Ocean and Atmospheric Administration's (NOAA's) programs, Ocean Exploration (OE) and the National Undersea Research Program (NURP), and more specifically on pending legislation H.R. 3835.

First, allow me to preface my remarks with the statement that I have nothing to gain personally from this legislation. My own research is not now and never has been funded by NOAA, and only an insignificant amount of my institution's entire budget is derived from NOAA programs. My motivation in addressing you today is simply to do what is right for the nation and for the oceans.

Next, I will explain my involvement with the Ocean Exploration and NURP programs. I chaired the 32-member President's Panel on Ocean Exploration which, in just 60 days, convened, deliberated, and completed a succinct report laying out the motivation, objectives, priorities, and essential elements of a comprehensive national program. This report led to the establishment of the NOAA exploration program and continues to guide it to this day. In addition, my institution has had a long-standing agreement with the West Coast office of NURP whereby NURP-funded investigators get access to my institution's unique ships and remotely operated vehicles for undersea research, neither of which are ordinarily available to outside users. This arrangement not only provides access to

state-of-the-art capabilities for academic and NOAA researchers, but also provides greater external visibility and demand for MBARI's technology and marine assets. The NURP program, while having hardly any impact on MBARI's budget, is an important factor in our technology transfer strategy.

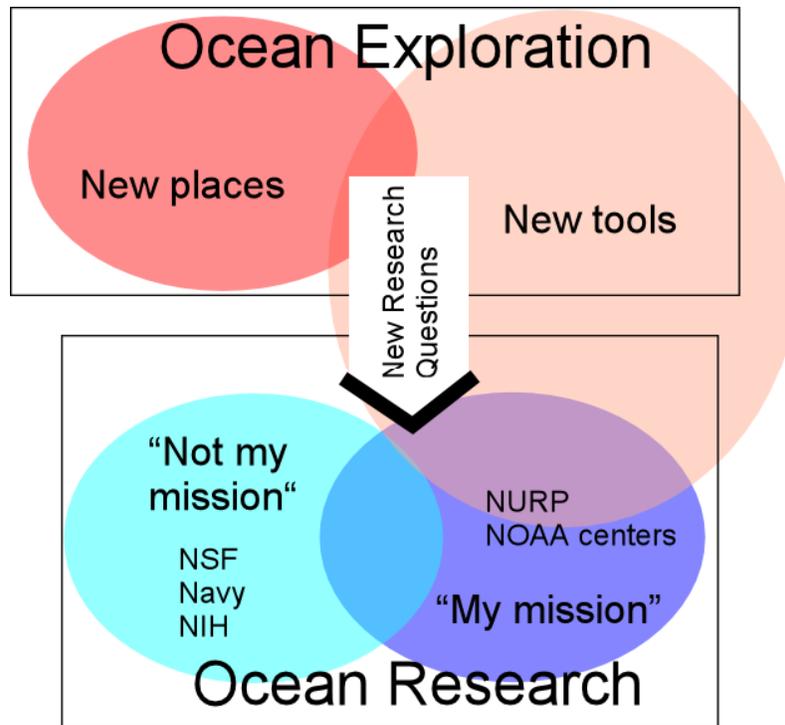
Let me briefly explain the importance of NOAA's Ocean Exploration program to the Nation and to NOAA. With a healthy and vigorous Ocean Exploration program, the Nation benefits from policy makers, such as yourselves, and citizens so inspired by the wonders and mysteries of the ocean that they insist on the acquisition and application of state of the art knowledge and understanding of the oceans for informed ocean management. Ocean Exploration supports NOAA's mission by exploring the ocean in all dimensions to make new and unexpected discoveries that overthrow reigning paradigms.

Ocean exploration is distinguished from research by the fact that exploration leads to questions, while research leads to answers. When one undertakes exploration, it is without any preconceived notion of what one might find or who might benefit from the discoveries. Research, on the other hand, is undertaken to test a certain hypothesis, with the clear understanding of the benefits of either supporting or refuting the hypothesis under consideration. Often novel discoveries are made accidentally in the process of performing hypothesis-driven research, but with a purposeful exploration program, those discoveries are more likely to be appreciated for what they are, properly documented, and followed-up.

Here is a concrete example. One of the greatest surprises in oceanography in the 20<sup>th</sup> century was the discovery of the hot-vent communities, deep-sea oases that thrive in sea water geothermally heated to several hundred degrees centigrade. These animals form an entire ecosystem completely independent of the sun's energy, and their existence opens up huge new possibilities for how life might be sustained elsewhere in the universe. This discovery led to a host of new research questions. What is the energy source for this new style of community? How do proteins fold at such high temperatures? By what reproductive strategy do deep-sea vent organisms manage to find and colonize new, isolated vent systems as the old ones die? These are important questions, but ones that we would not know enough to even ask had the discovery not happened. And it almost didn't. The shipboard party involved was entirely geologists and geophysicists. There wasn't a single biologist on board to appreciate the significance of what was to become the most important discovery in marine biology. Ever. Lacking basic biological

supplies, the geophysicists had to sacrifice all of their vodka to preserve the novel specimens they collected.

Such discoveries don't need to be rare, accidental, or potentially unappreciated with a strong, vigorous, and systematic ocean exploration program. I created a graphic (Figure 1) to show how NOAA's OE program might ideally relate to the broader ocean research agenda and to the NURP program.



*Figure 1. Conceptual diagram showing how the flow of new research questions from ocean exploration provides fertile ideas for new research directions. However, there is no guarantee at the time that the exploration is undertaken that the organization undertaking the exploration will be the organization to benefit from the discoveries.*

The upper box is meant to represent NOAA's Ocean Exploration program. New discoveries are made by exploring new places, and/or by deploying new tools which "see" the ocean in new dimensions. With roughly 95% of the ocean still unexplored, and new tools that image the physics, chemistry, biology, and geology of the ocean at all scales being developed constantly, the opportunities for discovery are virtually limitless. The greatest strength of having a federal organization such as NOAA leading this effort is the fact that it can undertake a systematic, multidisciplinary exploration of the ocean. However, if I had to identify NOAA's weakness in terms of being the lead agency for this effort, it is the fact that NOAA

is not widely known for its prowess in developing new technology. For this reason, I support the provision in HR 3835 that establishes an interagency task force which includes NASA and ONR to facilitate the transfer of new exploration technology to the program.

Those discoveries lead to new research questions. In the case of a NOAA Ocean Exploration program, some of the research questions will be quite relevant to NOAA's mission, while others will need to be pursued by other agencies, such as the National Science Foundation, Navy, or the National Institutes of Health. Again, the interagency task force established in HR 3835 will facilitate the sharing of discoveries with other parties who would be more likely to follow them up. Definitely the National Science Foundation should be added explicitly to this list, as it is most likely that NSF will support the early research resulting from exploration discoveries until such time as their relevance to other agency missions or commercial organizations is clear.

For those discoveries that are deemed relevant to NOAA's mission, the NURP program provides an excellent mechanism for research follow-up. The NURP program is peer reviewed, so that only the most exciting hypotheses proposed by the top researchers are pursued, and it provides access to the necessary deep-sea assets, such as manned submarine, remotely operated vehicles, and autonomous underwater vehicles. The NURP program can be considered something of a half-way house, serving as a bridge between OE's discoveries and eventual incorporation and application of the scientific knowledge and understanding within NOAA's line agencies.

NOAA's OE program is the only ocean exploration, *sensu stricto*, accomplished with federal funds. The only other organizations that undertake ocean exploration for the sake of unfettered discovery are my own institution, using funds we receive from the David and Lucile Packard Foundation, and Bob Ballard's Institute for Exploration. The NOAA OE program, thanks to some inspired and dedicated leadership within NOAA, is trying to build a first-class program. But they face two challenges. One is that, to date, exploration is not specifically in NOAA's mission statement. Exploration is part of NASA's mission, and NASA is the nation's space agency. Why shouldn't exploration be part of NOAA's mission, if NOAA is our oceans agency? It certainly isn't because we have already found everything that needs to be discovered! In the most recently released NOAA Strategic Plan, the words "ocean exploration" did not appear even once. I believe it would very much help the situation if under Section 103 in HR 3835, the NOAA Administrator was advised to add exploration to NOAA's mission. A second problem is the lack of sufficient funding for the program. The amount of funds appropriate for

OE is equivalent to the round-off error in NASA's budget. My own institution spends about \$30 M/year, twice OE's budget, exploring just Monterey Bay. It is a big ocean out there, and HR 3835 does a credible job at ramping up the OE budget authorization.

I was also asked to specifically comment on a potential merger of OE and NURP. Strengths of a merger would be in facilitating the transfer of exploration discoveries to research follow-up, as diagramed in Figure 1 above, and in turn making deep sea assets available to the Ocean Exploration program through mechanisms already in place with NURP. However, I also see many challenges. An ideal OE program undertakes multi-disciplinary voyages of discovery for the benefit of all of ocean sciences. NURP is intended to be more targeted in the projects it undertakes so as to serve the needs of NOAA's line agencies for basic scientific understanding. OE's "explorers" will not necessarily be the same people who will benefit from the discoveries. NURP investigators fully expect to be the ones who reap the scientific rewards from their efforts. OE must be systematic in its program in order to make any progress, whereas NURP has traditionally supported a portfolio of disconnected projects. OE will be most successful if there is strong central management to ensure common standards, professional data management, and extensive outreach, whereas NURP has employed a very distributed management system. If OE is managed like NURP or as a component of NURP, it would be a disaster. However, I believe that a relationship as I identified above in Figure 1 could be successful: NURP acting to follow up with OE discoveries. In that arrangement, OE sheds the burden of capitalizing on its discoveries deemed relevant to the missions of NOAA's line agencies, and can remain true to its focus on pure exploration for the benefit of all ocean sciences.

Thank you for this opportunity to comment, and I hope my views are of some help in your deliberations.

## ABBREVIATED CURRICULUM VITAE

### Marcia K. McNutt

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2/19/52            Born, Minneapolis, Minnesota  
6/70                Graduated from high school, Northrop Collegiate School,  
                         Minneapolis, Minnesota.  
5/73                B.A. in Physics from Colorado College, Colorado Springs, Colorado.  
1/78                Ph.D. in Earth Sciences from Scripps Institution of Oceanography, La  
                         Jolla, California. Dissertation title: Continental and Oceanic Isostasy.

### Awards and Fellowships

1970                Class valedictorian, recipient of awards for mathematics, science and  
                         French.  
1970-1971        National Merit Scholarship  
1973                Phi Beta Kappa, summa cum laude  
1973-1976        National Science Foundation Graduate Fellowship  
1977-1978        University of California Dissertation Fellowship  
1984, 1993        *Journal of Geophysical Research* Editor's Citation for Excellence in  
                         Refereeing  
1985                Graduate Student Council Award for Teaching  
1985-1986        Mary Ingraham Bunting Fellow, Radcliffe College  
1988                Macelwane Award, American Geophysical Union  
1988                Fellowship, American Geophysical Union  
1988                Doctor of Science, *honoris causa*, Colorado College  
1989-1990        NSF Visiting Professorship for Women, Lamont-Doherty Geological  
                         Observatory of Columbia University  
1991-7            Griswold Professor of Geophysics  
1993                Outstanding Alumni Award, The Blake Schools, Minneapolis  
1995                Capital Science Lecturer, Carnegie Institution  
1996-7            Phi Beta Kappa Visiting Scholar  
1996                MIT School of Science Graduate Teaching Prize  
1998                Fellowship, Geological Society of America  
1997                Science and Technology Fellow, CSU Monterey Bay  
1998                Fellowship, American Association for the Advancement of Science  
1999                Member, American Academy of Arts and Sciences  
1998                Sanctuary Reflections Award, Special Recognition Category,  
                         Monterey Bay National Marine Sanctuary  
2002                Elected member American Philosophical Society  
2003                ARCS Scientist of the Year  
2004                National Associate, National Academy of Science

2004 Alumna of the Year, University of California, San Diego  
2004 Doctor of Science, *honoris causa*, University of Minnesota  
2005 Elected member, National Academy of Sciences

### **Post-graduate Employment**

1/78-6/78 Postdoctoral Research Associate, Scripps Institution of Oceanography.  
6/78-7/79 Visiting Assistant Professor, University of Minnesota, Minneapolis.  
6/79-6/82 Geophysicist, Branch of Tectonophysics, Office of Earthquake  
Studies, U.S. Geological Survey, Menlo Park, California.  
7/82-7/86 Assistant Professor of Geophysics, Department of Earth, Atmospheric,  
and Planetary Sciences, Massachusetts Institute of Technology.  
7/86 Associate Professor of Geophysics, EAPS, MIT.  
7/89-3/98 Professor of Geophysics, EAPS, MIT  
7/93-7/95 Associate Director, MIT SeaGrant College Program  
7/95-8/97 Director, MIT/WHOI Joint Program in Oceanography and Applied  
Ocean Science and Engineering  
9/97-present President/CEO Monterey Bay Aquarium Research Institute  
6/98-present Professor, Department of Earth Science, UC Santa Cruz (on leave)  
10/98-present Professor of Geophysics, Stanford University

### **Special Training**

8/74 Completed US Navy UDT and Seal Team training course in  
underwater demolition and explosives handling. Also, NAUI certified  
SCUBA diver and Red Cross Water Safety Instructor.

### **Sea Experience**

Participant on 14 oceanographic expeditions on ships from Scripps, Woods Hole, Oregon  
State University, and Columbia University.  
Co-chief scientist on *Crossgrain 2* marine geophysical expedition to the Marquesas  
Islands, April 1987.  
Co-chief scientist on the R/V *Maurice Ewing* EW9103 multichannel seismic expedition  
to French Polynesia, May, 1991  
Chief scientist on the R/V *Maurice Ewing* EW9106 marine geophysical survey of the  
Marquesas Fracture Zone, September-October, 1991  
Chief scientist on the R/V *Maurice Ewing* EW9204 ocean bottom seismometer  
experiment in the Marquesas Islands, May, 1992  
Co-chief scientist on BARGE, a multichannel seismic survey on Lake Mead of the  
Colorado Plateau - Basin and Range breakaway zone, March, 1994  
Chief scientist on R/V *Maurice Ewing* EW9602, multichannel seismic survey of the  
Austral Islands, March-May, 1996  
Chief scientist on R/V *Roger Revelle* expedition to measure hydrothermal heat flux in the  
Hawaiian Islands, August-September, 1997

## Professional Societies

American Geophysical Union (Fellow)  
American Association for the Advancement of Science (Fellow)  
Geological Society of America (Fellow)

## Other Activities

### Past

*Journal of Geophysical Research* Associate Editor, 1980-1983  
*Journal of Geophysical Research* guest editor, 1983  
*Pure and Applied Geophysics*, editorial board, 1987-88  
Member, IUGG special studies group on density and stress differences within the earth, 1980-1983  
Member, IUGG special studies group on geodynamics of mountain belts, 1983-1987  
Member, NSF panel for graduate fellowships in Earth Sciences, 1985, 1986, 1987  
(Chairman 1988, 1989, 1990)  
NSF Ocean Sciences, Panelist, 1986-1988, 1990  
NSF Science and Technology Centers Panelist 1989  
Member NASA science steering group for the Geopotential Research Mission 1978-1988.  
Chairman, Science Working Group, NASA Gradiometer Study Team, 1987  
Panel co-chairman, NASA Coolfont Workshop, 1989  
Member, Committee on Geodesy, National Research Council, 1982-1984  
Member, Geodynamics Committee, National Research Council, 1984-1987  
Member, Earth Science Committee, National Research Council, 1987-1989  
Member, AGU Tectonophysics nominating committee, 1983, 1985  
Member, AGU Budget and Finance Committee, 1986-1988  
Chairman, AGU Journals Board, 1988-1990  
Chairman, Tectonophysics Fellows Committee, AGU, 1990, 1992  
Chairman, AGU Publications Committee, 1990-1992  
Member, *Tectonics* editor search committee, 1983  
Member, Lithosphere Panel, Ocean Drilling Program, 1986-1988  
Member, National Earthquake Hazard Reduction Program Advisory Committee, 1991  
Chairman, AGU Publications Committee, 1990-1992  
Chairman, Joint Committee for Marine Geology and Geophysics, MIT/WHOI Joint Program, 1984-1988, 1991-1995  
President, special study group "Transmission of Stress and Geodynamic Implication", International Association of Geodesy, 1987-1991  
*Tectonophysics* editorial board, 1982-1991  
Member, Atolls and Guyots Detailed Planning Group, Ocean Drilling Program, 1991  
Member, Performance Evaluation Committee, Ocean Drilling Program, 1991  
Member, Organizing Committee for the Frontiers of Science Symposium, National Academy of Sciences, 1991-2, 1994  
Chairman, Visiting Committee, Geological Sciences Department, U of Arizona, 1992

Member, Advisory Committee for Earth Sciences, National Science Foundation, 1990-1993

Member, NASA Earth Science and Applications Division Advisory Subcommittee, 1990-1993

Member, Advisory Structure Review Committee, Ocean Drilling Program, 1992-1993

Chairman, Organizing Committee for the Frontiers of Science Symposium, National Academy of Sciences, 1993

Chairman, Visiting Committee, Scripps Institution of Oceanography, 1993

SEI (Study of the Earth's Interior) Committee, American Geophysical Union, 1992-1994

Audit and Legal Affairs Committee, American Geophysical Union, 1992-1994

Nominating Committee, American Geophysical Union, 1992-1994

Member, Board on Earth Sciences and Resources, National Research Council, 1994

Member, Committee on Geophysical and Environmental Data, National Research Council, 1994

Member, National Academy of Sciences Television Advisory Committee, 1994

Member, Committee to Study the Criteria for Federal Support for Research and Development (Press Committee), 1995

President, Tectonophysics section, American Geophysical Union, 1992-1994

Chair, Audit and Legal Affairs Committee, American Geophysical Union, 1994-1996

Member, Organizing Committee for the German-American Frontiers of Science Symposium, 1995, 1996

Chair, External Review Committee, Department of Geological Sciences, UC Santa Barbara, 1997

Member, External Review Committee, Department of Geology and Geophysics, U of Minnesota, 1997

Member, Lincoln Lab Advisory Board, 1994-1997

Member, National Medal of Science Committee, 1995-1997

Member, New England Aquarium Advisory Board, 1995-1997

Co-Chair, NSF-OCE Workshop on the Future of Marine Geosciences, 1995-1998

Vice-Chair, Advisory Committee for Geosciences, National Science Foundation 1996-1998

Chair, Macelwane Award Committee, American Geophysical Union, 1996-1998

Co-Chair, Chinese-American Frontiers of Science Symposium, August, 1998

Member, Government-University-Industry-Research-Roundtable committee on Stress in Universities, 1995-1998

Member, NRC committee on the Science of Earthquakes, 1996-1999

Member, NRC Committee on 50 Years of Ocean Sciences at NSF, 1998

Member, ODP Executive Committee for Drilling Opportunities in the 21st Century, 1998-9

Member, German-American Academic Council, 1994-1999

Member, Ocean Research Advisory Panel, National Ocean Partnership Program, 2000-2001

Member, Ocean Science Synthesis Committee, NSF 1998-2001

Chair, NOAA Exploration Panel, 2000-2001

President, American Geophysical Union 2000-2002

Member, Exploration of the Seas Committee, National Research Council, 2001-2004

Member, Review Committee for the Division on Earth and Life Sciences, National Academy of Sciences, 2003-2004  
Member, Jackson School Vision Committee, University of Texas at Austin, 2003-2004  
Past President, American Geophysical Union, 2002-2004  
Member, Visiting Committee, Department of Ocean Engineering, MIT 1999-2004  
Chair, Ocean Research Advisory Panel, National Ocean Partnership Program, 2001-2005

### Present

Member, Visiting Committee, Department of Mechanical Engineering, MIT 2005-present  
Whale Conservation Fund Advisory Council 2004-present  
Member, Visiting Committee, School of Earth Sciences, Stanford University, 1999-present  
Chair, Visiting Committee, Department of Earth and Planetary Science, Harvard University, 2002-present  
Member, External Review Committee for Marine Science Institute, University of California at Santa Barbara, 2006  
Member, Advisory Board, Winchell School of Earth Sciences, University of Minnesota, 2005-present  
Member, Board of Directors, Monterey Bay Aquarium, 1998-present  
Member, Schlumberger Technical Advisory Committee, 2000-present  
Member, Editorial Advisory Committee, *Science* magazine, 2001-present  
Chair, Monterey Bay Crescent Ocean Research Consortium, 2000-2006  
Chair-elect, Board of Directors, Joint Oceanographic Institutions  
Member, Ocean Council, joint task force for Joint Oceanographic Institutions and the Consortium for Ocean Research and Education  
Member, Class membership committee, National Academy of Sciences  
Reviewer for *JGR*, *GJRAS*, *Tectonophysics*, *Nature*, *Tectonics*, *Journal of Geophysics*, *EPSL*, *PEPI*, *GRL*, *RGSP*, *PAGEOPH*, NSF, NASA, LPRI, NERC

### **Invited Lectures**

Caltech (1978, 1980, 1997), U. of Minnesota (1978, 1996, 125<sup>th</sup> Anniversary Lecturer, 1999, IT Distinguished Woman Lecturer, 2003, 2005), Harvard (1978, 1984), U.C. Santa Barbara (1978, 1981), Cornell University (1978, 1983), U. of Michigan (1979, 1989, 1994), Dalhousie (1979), Lamont-Doherty (1980, 1985, 1986, 1989, 1995; 50<sup>th</sup> Anniversary Lecture 1999), Stanford (1980, 1984, 1998, 2003), Sandia Labs (1981), MIT (1981; Wallace Lecture: 1998, 2005), Woods Hole (1981, 1985, 1987, 1989), UC Berkeley (1982; 1989; 1995; 1998), UCLA (1982, 1989), Society of Engineering Science (1982), Washington University at St. Louis (1982), Brown (1983, 1989, 1994), Yale (1983, 1985, 1995), Scripps Institution of Oceanography (80th Anniversary Lecturer: 1983; 1995, 2002), 27th International Geological Congress, Moscow (1984), Institute of Physics of the Earth, Moscow (1984, 1987), U. of Wyoming (1985, Dedication of Geosciences Building: 1998), Colorado College (1985, 1988, 2003), SUNY Stony Brook (1985), IUGG Workshop in Zurich (1985), U. Lowell (1986), University of Rhode Island (1986, 1994), Radcliffe Summer Science Program (1986, 1987), WHOI College Teachers

Workshop (1987), Geological Society of Washington (1988, 2005), IGPP Los Alamos (1989), IPG, Paris (1989, 1996), Institute of Computational Geophysics, Moscow (1989), Institute of Petroleum Research, Tel Aviv (1989), York University (1990), University of North Carolina, Chapel Hill (1990), Northwestern (1990), Penn State (1990), University of New Mexico (1991), University of Texas at Austin (1991), Boston University (1992), Duke University (1992), UMass, Amherst (1992, 1996), U of Washington (1993), Princeton University (1993), National Academy of Sciences (1994), Keystone *Scientist to Scientist* Colloquium (1994), Berlin Symposium on Issues Facing the German-American Academic Council (1994), U of Toronto (1994; J. Tuzo Wilson Lecture, 2004), MacMaster University (1994), University of Maine (1995), Workshop on Science Education, University of Iowa (1995, 1996), Amherst College (1996), Smith College (1996), University of Brest, France (1996), Western Maryland College (1996), Hiram College (1997), Carnegie-Mellon University (1997), St. Lawrence University (1997), Birmingham-Southern College (1997), University of Wisconsin at Milwaukee (1997), Ripon College (1997), College of St. Catherine (1997), University of Hawaii (1998), UC Santa Cruz (1998), Augsburg College (Sverdrup Lectures: 1998), Arizona State University (1998), AAAS (1998, 1999), Library of Congress (1999), US Geological Survey (2000), Purdue University (Crough Lecture, 2000), White House Millennium Matinee (2000), Trinity University (2000), University of Utah (2001), ACM1 Computer Conference (Keynote Speaker, 2001), Revelle Lecture (NAS, 2001), American Academy of Arts and Sciences (2001), Oceans 2001 (Keynote lecture, 2001), University of South Carolina (Convocation Speaker, 2002), Ocean's Symposium, Anchorage, AL (2002); JAMESTEC 30<sup>th</sup> Anniversary Symposium (2002), Oregon State University (Condon Lecture: 2002, 2005), University of California, San Diego (2002), Illinois Math and Science Academy (2003), ARCS Foundation (2003), Women in Science and Engineering, UCSD (2003), Nuclear and Space Radiation Effects keynote speaker (2003), Division of Planetary Sciences, American Astronomical Society plenary speaker (2003), Barrow Arctic Science Consortium public lecture (2003), Portuguese-American Foundation Annual Lecture in Marine Sciences, Lisbon (2004), 9<sup>th</sup> Circuit Court Judicial Conference (2004); Marin County Women Lawyers (2004), MIT- ME dept (2005), Santa Fe Institute (2005), Naval Postgraduate School (2005), PopTech (2005), Space Mission Challenges (2006).

### **PEER REVIEWED PUBLICATIONS**

1. McNutt, M.K. and R.L. Parker, Isostasy in Australia and the evolution of the compensation mechanism, *Science*, 199, 773-775, 1978.
2. McNutt, M.K. and H.W. Menard, Lithospheric flexure and uplifted atolls, *J. Geophys. Res.*, 83, 1206-1212, 1978.
3. Shih, J.S.F., T. Atwater, and M.K. McNutt, A near-bottom geophysical traverse of the Reykjanes Ridge, *Earth Planet. Sci. Lett.*, 39, 75-83, 1978.
4. McNutt, M.K., Continental and Oceanic Isostasy, Ph.D. thesis, University of California, San Diego, California, 1978.
5. McNutt, M.K. and H.W. Menard, Reply to comments on 'Lithospheric flexure and uplifted atolls' by R.D. Jarrard and D.L. Turner, *J. Geophys. Res.*, 84, 5695-5697, 1979.

6. McNutt, M.K., Compensation of oceanic topography: An application of the response function technique to the *Surveyor* area, *J. Geophys. Res.*, *84*, 7589-7598, 1979.
7. McNutt, M.K. and H.W. Menard, Reply to comments on 'Lithospheric flexure and uplifted atolls' by H.T. Stearns, *J. Geophys. Res.*, *84*, 7698, 1979.
8. Parker, R.L. and M.K. McNutt, Statistics for the one-norm misfit measure, *J. Geophys. Res.*, *85*, 4429-4430, 1980.
9. McNutt, M.K., Implications of regional gravity for state of stress in the earth's crust and upper mantle, *J. Geophys. Res.*, *85*, 6377-6397, 1980.
10. McNutt, M.K. and Thomas Heaton, An evaluation of the seismic window theory for earthquake prediction, *California Geology*, *34*, 12-16, 1981.
11. McNutt, M.K. and Rodey Batiza, Paleomagnetism of Northern Cocos seamounts: Constraints on absolute plate motion, *Geology*, *9*, 148-154, 1981.
12. Rundle, John and M.K. McNutt, Southern California uplift: Is it or isn't it? *EOS, Trans. Amer. Geophys. Union*, *62*, 97-98, 1981 (refereed journal article).
13. Chase, C.G. and M.K. McNutt, The geoid: effect of compensated topography and uncompensated trenches, *Geophys. Res. Lett.*, *9*, 29-32, 1982.
14. McNutt, M.K. and H.W. Menard, Constraints on yield strength in the oceanic lithosphere derived from observations of flexure, *Geophys. J. Roy. Astr. Soc.*, *71*, 363-395, 1982.
15. Menard, H.W. and M.K. McNutt, Evidence for and consequences of thermal rejuvenation of the lithosphere, *J. Geophys. Res.*, *87*, 8570-8580, 1982.
16. Dixon, T.H., M. Naraghi, M.K. McNutt and S.M. Smith, Bathymetric prediction from SEASAT altimeter data, *J. Geophys. Res.*, *88*, 1563-1571, 1983.
17. McNutt, M.K., Influence of plate subduction on isostatic compensation in northern California, *Tectonics*, *2*, 399-415, 1983.
18. McNutt, M.K., Reply to comments on "Nasal surgery and airflow", *Plastic and Reconstructive Surgery*, *73*, 700-701, 1984.
19. McNutt, M.K., Lithospheric flexure and thermal anomalies, *J. Geophys. Res.*, *89*, 11, 180-11, 194, 1984.
20. Committee on Geodesy, *Geodesy: A Look to the Future*, National Academy Press, Washington, D.C., 1985.
21. McNutt, M.K., Nonuniform magnetization of seamounts: a least-squares approach, *J. Geophys. Res.*, *91*, 3686-3700, 1986.
22. Sheffels, B. and M.K. McNutt, The role of subsurface loads and regional compensation in the isostatic balance of the Transverse Ranges, California: Evidence for intracontinental subduction., *J. Geophys. Res.*, *91*, 6419-6431, 1986.
23. McNutt, M.K. and L. Shure, Estimating the compensation depth of the Hawaiian swell with linear filters, *J. Geophys. Res.*, *91*, 13915-13923, 1986.
24. Fischer, K., M.K. McNutt, and L. Shure, Thermal and mechanical constraints on the lithosphere beneath the Marquesas swell, *Nature*, *322*, 733-736, 1986.
25. McNutt, M.K. and L. Royden, Extremal bounds on geotherms in eroding mountain belts from metamorphic pressure-temperature conditions, *Geophys. J. Roy. Astr. Soc.*, *88*, 81-95, 1987.

26. Kogan, M.G. and M.K. McNutt, Isostasy in the USSR I: Admittance data, in *The Composition, Structure, and Dynamics of the Lithosphere-Asthenosphere System*, K. Fuchs and C. Froidevaux, eds., Geodynamics Series, AGU, vol. 16, 1987.
27. McNutt, M.K. and M.G. Kogan, Isostasy in the USSR II: Interpretation of admittance data, in *The Composition, Structure, and Dynamics of the Lithosphere-Asthenosphere System*, K. Fuchs and C. Froidevaux, eds., Geodynamics Series, AGU, vol. 16, 1987.
28. McNutt, M.K., Lithospheric stress and deformation, *Rev. Geophys.*, 25, 1245-1253, 1987.
29. McNutt, M.K. and K.M. Fisher, The South Pacific superswell, in *Seamounts, Islands, and Atolls*, B. Keating, P. Fryer, R. Batiza, and G.W. Boehlert, eds., Geophysical Monograph #43, American Geophysical Union, Washington, D.C., 1987.
30. McNutt, M.K., Temperature beneath midplate swells: the inverse problem, in *Seamounts, Islands, and Atolls*, B. Keating, P. Fryer, R. Batiza, and G.W. Boehlert, eds., Geophysical Monograph #43, American Geophysical Union, Washington, D.C., 1987.
31. McNutt, M.K., Thermal and mechanical properties of the Cape Verde Rise, *J. Geophys. Res.*, 93, 2784-2794, 1988.
32. McNutt, M.K., M. Diament, and M.G. Kogan, Variations in elastic plate thickness at continental thrust belts, *J. Geophys. Res.*, 93, 8825-8838, 1988.
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