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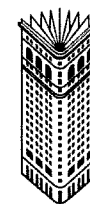
MERCHANTS OF DOUBT

*How a Handful of Scientists
Obscured the Truth on Issues from
Tobacco Smoke to Global Warming*

NAOMI ORESKES
and
ERIK M. CONWAY

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BLOOMSBURY PRESS
New York • Berlin • London

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Published by Bloomsbury Press, New York

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LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Oreskes, Naomi.

Merchants of doubt : how a handful of scientists obscured the truth on issues from tobacco smoke to global warming / Naomi Oreskes and Erik M. Conway.—1st U.S. ed.
p. cm.

Includes bibliographical references and index.

ISBN: 978-1-59691-610-4 (alk. paper hardcover)

1. Scientists—Professional ethics. 2. Science news—Moral and ethical aspects.
3. Democracy and science. I. Conway, Erik M., 1965– II. Title.

Q147.O74 2010

174'.95—dc22

2009043183

First U.S. edition 2010

1 3 5 7 9 1 0 8 6 4 2

Typeset by Westchester Book Group
Printed in the United States of America by Worldcolor Fairfield

*To Hannah and Clara
It's in your hands now.*

to organize his work. The outfit was initially affiliated with the Washington Institute for Values in Public Policy, which was itself financed by the Reverend Sun Myung Moon's Unification Church.⁷⁴ (The Unification Church was known for its passionate anti-Communism, perhaps an attraction to Singer. One of its supporters was Eugene Wigner, the Ph.D. advisor and mentor of Fred Seitz.)⁷⁵ The church owned a newspaper, the *Washington Times*, and it also operated a publisher, Paragon House. In the years to come, Singer would use both to expand the reach of his views.

In 1991, Singer reiterated his claim that the science of ozone depletion was too uncertain in the *Washington Times* and *Consumers' Research Magazine*. He also introduced a new argument: that the Ozone Trends Panel was wrong to use the "ground-based rather than the more accurate satellite ozone data."⁷⁶ But we've seen that the satellite data had shown *larger* depletions, and that the panel had concluded that the higher satellite-derived depletion rate was an artifact of instrument decay in space (a phenomenon that should have been very familiar to Singer, given his origins in rocket research). If the panel had used the satellite data, Singer no doubt would have attacked them for ignoring the problem of instrument decay.

But whether or not they had any basis in fact, Singer's efforts began to bear fruit. In 1990, Dixy Lee Ray, a zoologist and former chair of the Atomic Energy Commission, as well as former governor of the state of Washington, was the lead author of the book *Trashing the Planet: How Science Can Help Us Deal with Acid Rain, Depletion of Ozone, and Nuclear Waste (Among Other Things)*. Billed as an effort "to separate fact from factoid, to unmask the doom-crying opponents of all progress, and to re-establish a sense of reason and balance with respect to the environment and modern technology," it was a tirade against the environmental movement—and the science that supported it.⁷⁷ Ray dismissed energy conservation and renewable energy, attacked toxic chemical "scares" promoted by environmentalists, and constructed a narrative that sedulously omitted the findings of the scientific experts and replaced them with the claims of professional critics and skeptics. Here's what she had to say about ozone.

Although there is widespread belief that the necessary chloride ion [that damages ozone] comes from chlorofluorocarbon this has not been unequivocally established. On the other hand, the eruption of Mount St. Augustine in 1976 injected 289 billion kilograms of hydrochloric acid directly into the stratosphere. That amount is 570 times the total world production of chlorine and

fluorocarbon compounds in the year 1975. Mount Erebus, which is located just 15 kilometers upwind from McMurdo Sound, has been erupting, constantly, for the last 100 years, ejecting more than 1,000 tons (907,184 kg) of chlorine per day . . . We cannot be sure where the stratospheric chloride comes from, and whether humans have any effect upon it.⁷⁸

Where did she get these claims? Ray cited a 1989 article by Singer in his *Global Climate Change*, which she praised as one of only two "significant, critical contributions" to the subject of ozone depletion and global warming—the other being the National Acid Precipitation Assessment Program, which had nothing to do with either ozone or global warming.⁷⁹ If you read Singer's paper, you find that he presented no original data. He had simply cited other papers, without explaining what those papers actually said.

The details about Mt. Erebus and Mt. Augustine can actually be found in two articles, published in 1989, by a man named Rogelio Maduro, in a political magazine called *21st Century Science and Technology*, which is supported by Lyndon LaRouche's organization.⁸⁰ In 1992, Maduro would publish a book, *The Hole in the Ozone Scare: The Scientific Evidence that the Sky Isn't Falling*, but the basic argument was already laid out in his 1989 work.⁸¹ Maduro had concluded that the ozone depletion theory was a "fraud" after interviewing Reid Bryson for an article on the "hoax" of global warming. Bryson, an expert on paleoclimate studies using pollen and tree rings—nothing to do with ozone—had told Maduro that Mt. Erebus erupted more chlorine into the atmosphere in a week than CFCs released in a year.

Ray had apparently confused chlorine emission to the atmosphere and chlorine concentration in the stratosphere. Mt. Erebus did produce substantial chlorine emissions, but it did not erupt explosively, so whatever chlorine it released did not get injected into the stratosphere; it would have to have been transported upward by tropospheric winds. Yet the Antarctic data collected by the two NASA/NOAA field expeditions showed very little chlorine in the troposphere and a great deal in the stratosphere. Moreover, balloon measurements showed that the bitterly cold stratospheric air was sinking, not rising, so there was simply no way that air masses carrying materials upward from Mt. Erebus could be the source of the chlorine.

Maduro's claims were published in an obscure source, and they might easily have vanished into obscurity—but for Dixy Lee Ray. When she repeated them in her book, they suddenly gained currency and credibility.

After all, she was a scientist, and had been chairman of the Atomic Energy Commission. Surely she was credible? The press thought so, as the mass media extensively reviewed the *Trashing* book. It sold well enough that Ray expanded it into a 1993 bestseller, *Environmental Overkill*. In addition to repeating the claims of the 1990 book, Ray expanded them, by insisting that CFCs were too heavy to rise into the stratosphere in the first place!⁸²

Sherry Rowland was disturbed by the rapid spread of this misinformation and dedicated his 1993 AAAS presidential address to combating it.⁸³ Without naming names, Rowland chided “senior scientists” for helping to spread such erroneous claims. Then he addressed specifics, starting with the idea that CFCs didn’t reach the stratosphere. In fact, CFCs had been measured “in literally thousands of stratospheric air samples by dozens of research groups all over the world.”⁸⁴

Rowland also addressed the volcano red herring. First, he debunked the 1980 *Science* paper that had argued that a single eruption of Mt. Augustine, Alaska, in 1976 had put as much chlorine into the stratosphere as the entire 1975 CFC production. That claim was based on the chlorine content of ashfall, not on what had actually reached the stratosphere. Rainout would have reduced the amount reaching the stratosphere, but the rain’s chemistry hadn’t been measured. “No actual evidence was presented in this *Science* paper to show that any hydrogen chloride had really reached the stratosphere in this volcanic plume.”⁸⁵ He then recounted evidence that the eruption of El Chichón in April 1982 had produced an increase of hydrogen chloride in the stratosphere of less than 10 percent, and that the June 1991 eruption of Pinatubo—a much larger eruption—had increased it even less. Yet hydrogen chloride levels had increased steadily between those two eruptions, despite the lack of any other explosive eruptions during the interceding nine years. This showed conclusively that the chlorine did *not* come from volcanoes.

Rowland traced the next phase of confusion over volcanic effects to Fred Singer’s 1989 *National Review* article. The confusion had been amplified by Ray’s attributing extremely high chlorine releases to Mt. Augustine.⁸⁶ This had been taken as fact by people “who are relying, often unquestioningly, upon such fourth-hand descriptions of the volcano problem, rather than going back to the original literature.” Then the error had been broadcast far and wide by a variety of media outlets.⁸⁷

ROWLAND’S ATTEMPT TO CORRECT these errors didn’t make a difference. In March 1994, Singer repeated the now-refuted claim that the evidence “sug-

gest[ed] that stratospheric chlorine comes mostly from natural sources.”⁸⁸ In September 1995, Singer served as a star witness in hearings in the U.S. Congress, sponsored by Republican congressman Dana Rohrabacher—on “scientific integrity.” Singer recycled some of his earlier claims and concluded that the committee was being “misled, bamboozled, and otherwise manipulated” by the testimony of Robert Watson, former director of the NASA Upper Atmosphere Research Panel and currently at the Office of Science and Technology Policy. Referring to the issue as “so-called” ozone depletion, he asserted that scientific basis for concern was simply “wrong.”⁸⁹ In his written statement to the committee, Singer added that there was “no scientific consensus on ozone depletion or its consequences.”⁹⁰ Just a few weeks later, Sherry Rowland shared the 1995 Nobel Prize in Chemistry with Mario Molina and Paul Crutzen for their work on the understanding of stratospheric ozone chemistry—the highest honor any scientist can achieve—and the clearest possible evidence of broad acceptance and appreciation of one’s work.⁹¹

So Singer attacked the Nobel committee, too. “In awarding the 1995 Nobel Prize in Chemistry to the originators of the stratospheric ozone depletion hypothesis, the Swedish Academy of Sciences has chosen to make a political statement,” he began, writing again in the *Washington Times*. Swedish public opinion had supported the “hasty phaseout” of CFCs and even a “putative carbon tax to turn back a global climate warming that has not even been detected yet . . . In short, the country is in the throes of collective environmental hysteria.”⁹²

Did all of Singer’s efforts to discredit mainstream science matter? When asked in 1995 where he got his assessments of ozone depletion, House Majority Leader Tom DeLay, probably the most powerful man in Congress at the time, said, “my assessment is from reading people like Fred Singer.”⁹³

What Was This Really About?

Everyone is entitled to an opinion. But when a scientist consistently rejects the weight of evidence, and repeats arguments that have been thoroughly rebutted by his colleagues, we are entitled to ask, What is really going on?

From 1988 to 1995, Singer insisted that the ozone research community was misleading the public about even the existence of ozone depletion, let alone its origins. He argued in his 1989 *National Review* article that

58. John B. Judis, *The Paradox of American Democracy* (New York: Pantheon Books, 2000). On the anti-environmental aspects of late twentieth century conservatism, Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987), 491; Hal K. Rothman, *Saving the Planet: The American Responses to the Environment in the Twentieth Century* (Chicago: Ivan R. Dee, 2000), 158.
59. Judis, *The Paradox of American Democracy*, 125. See also Edwin J. Feulner Jr., interview by Adam Meyerson, "Building the New Establishment," *Policy Review* 58 (Fall 1991): 6-16.
60. Judis, *The Paradox of American Democracy*, 124-27.
61. "S. Fred Singer, Ph.D. Professional Background," <http://www.sepp.org/about%20sepp/bios/singer/cvdfs.html>.
62. S. Fred Singer, "Ozone Scare Generates Much Heat, Little Light," *Wall Street Journal*, April 16, 1987, 1.
63. Ibid.
64. Ibid.
65. S. Fred Singer, "Does the Antarctic Ozone Hole Have a Future?" *EOS* 69, no. 47 (November 22, 1988): 1588.
66. Ibid.
67. V. Ramanathan, "The Greenhouse Theory of Climate Change: A Test by an Inadvertent Global Experiment," *Science* 240, no. 4850 (April 15, 1988): 293-99.
68. Committee on Energy and Natural Resources, *Hearing on Greenhouse Effect and Global Climate Change*, 100th Congress, 1st sess., November 9, 1987 (Washington, D.C.: U.S. Government Printing Office, 1987), 53; also see J. Hansen et al., "Global Climate Changes as Forecast by Goddard Institute for Space Studies Three-Dimensional Model," *Journal of Geophysical Research* 93: D8 (August 20, 1988): 9341-64.
69. S. Fred Singer, "My Adventures in the Ozone Layer," *National Review* (June 30, 1989): 34-38, quoted from 36.
70. Ibid. The discussion of Dobson is on p. 37; the quote regarding CFCs is on p. 38.
71. See Roan, *Ozone Crisis*, chap. 11.
72. Christie, *The Ozone Layer*, 46-47.
73. The major consumer-level CFC replacement, HFC-134a, has "comparable cycle efficiency," and energy efficiency standards adopted for refrigerators in 1990 actually led to a large reduction in energy consumption despite the adoption of non-CFC refrigerants. See James R. Sand et al., *Energy and Global Warming Impacts of HFC Refrigerants and Emerging Technologies* (Washington, D.C.: U.S. Department of Energy, 1997), 22.
74. See "Washington Institute for Values in Public Policy," SourceWatch, http://sourcewatch.org/index.php?title=Washington_Institute_for_Values_in_Public_Policy; Singer wrote to Roger Revelle on Washington Institute letterhead during 1990: see Singer to Revelle, 2 March 1990, Revelle Papers, MC6A, 150: 10, Scripps Institute of Oceanography (SIO) Archives.
75. Wigner's link to the Unification Church is discussed in Frederick Seitz et al., *Eugene Paul Wigner, Biographical Memoirs v. 74* (Washington, D.C.: National Academy Press, 1998), 364-88, http://books.nap.edu/openbook.php?record_id=6201&page=365.
76. S. Fred Singer and Candace Crandall, "Misled by Lukewarm Data," *Washington Times*,

- May 30, 1991, final edition, sec. G; S. Fred Singer, "The Science Behind Global Environmental Scares," *Consumers' Research Magazine* 74, no. 10 (October 1991): 17. The quotation is from the *Washington Times* article.
77. Dixy Lee Ray and Lou Guzzo, *Trashing the Planet: How Science Can Help Us Deal with Acid Rain, Depletion of the Ozone, and Nuclear Waste (Among Other Things)* (New York: HarperPerennial, 1990), 12; originally published by Regnery Gateway, 1990.
78. Ibid., 45.
79. Ibid., 175; see also Singer, *Global Climate Change*.
80. Rogelio Maduro, "The Ozone Layer that Won't Go Away," *21st Century Science and Technology* 2 (September/October 1989): 26; and Rogelio Maduro, "The Myth Behind the Ozone Hole Scare," *21st Century Science and Technology* 2 (July/August 1989): 11.
81. Rogelio A. Maduro and Ralf Schauerhammer, *The Holes in the Ozone Scare: The Scientific Evidence that the Sky Isn't Falling* (Washington, D.C.: 21st Century Science Associates, 1992), intro. and chap. 1. For another analysis of their "facticity," see Christie, *The Ozone Layer*, 185-202.
82. Dixy Lee Ray with Lou Guzzo, *Environmental Overkill: Whatever Happened to Common Sense?* (Washington, D.C.: Regnery Gateway, 1993), 35.
83. Gary Taubes, "The Ozone Backlash," *Science* 260 (June 11, 1993): 1580-83.
84. F. Sherwood Rowland, "President's Lecture: The Need for Scientific Communication with the Public," *Science* 260 (June 11, 1993): 1571-1576, on p. 1573.
85. Ibid., 1574.
86. David A. Johnston, "Volcanic Contribution of Chlorine to the Stratosphere: More Significant to Ozone than Previously Estimated?" *Science* 209, no. 4455 (July 25, 1980): 491-93.
87. F. Sherwood Rowland, "President's Lecture," 1574.
88. S. Fred Singer, "The Hole Truth about CFCs," *Chemistry & Industry* (March 21, 1994): 240. See also S. Fred Singer, "Bad Science Pulling the Plug on CFCs?" *Washington Times*, February 22, 1994, final edition, sec. A.
89. House Committee on Science, Subcommittee on Energy and the Environment, *Hearing on Scientific Integrity and Public Trust: The Science Behind Federal Policies and Mandates: Case Study 1—Stratospheric Ozone: Myths and Realities*, S. Fred Singer testimony, 104th Congress, 1st sess., September 20, 1995 (Washington, D.C.: U.S. Government Printing Office, 1996), 50-64, quotes on p. 50 ("misled") and p. 52 ("wrong").
90. Ibid., 54.
91. "The Nobel Prize in Chemistry 1995," Nobelprize.org, http://nobelprize.org/nobel_prizes/chemistry/laureates/1995/.
92. S. Fred Singer, "Ozone Politics with a Nobel Imprimatur," *Washington Times*, November 1, 1995, final edition, sec. A15.
93. William K. Stevens, "G.O.P. Bills Aim to Delay Ban on Chemical in Ozone Dispute," *New York Times*, September 21, 1995, A20, <http://www.nytimes.com/1995/09/21/us/gop-bills-aim-to-delay-ban-on-chemical-in-ozone-dispute.html>.
94. Singer, "My Adventures in the Ozone Layer," 36.
95. Data from Science and Environmental Policy Project IRS Form 990 for 2007 (lines 8d and 21), dated 15 May 2008.
96. Singer, "My Adventures in the Ozone Layer," 36-37.