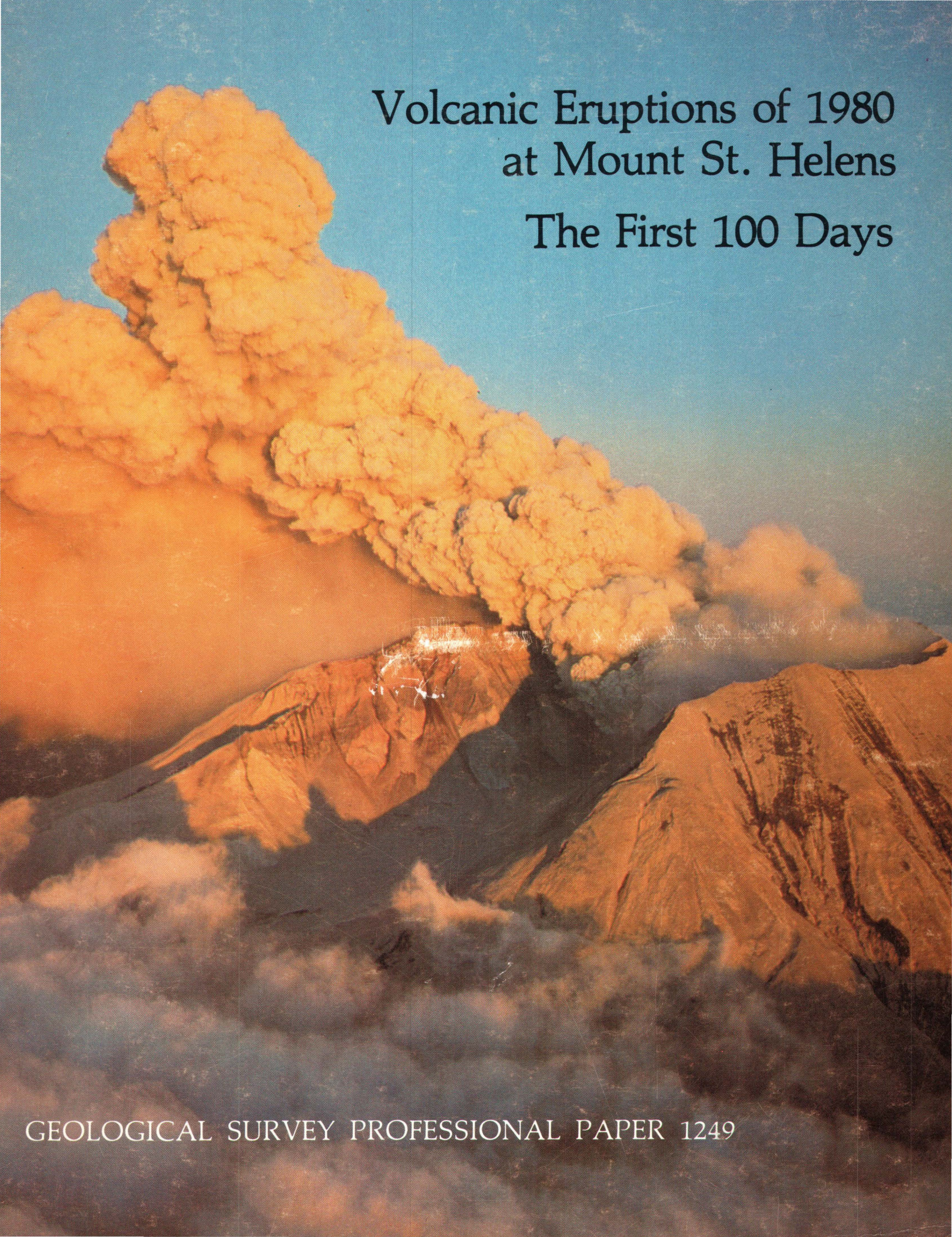
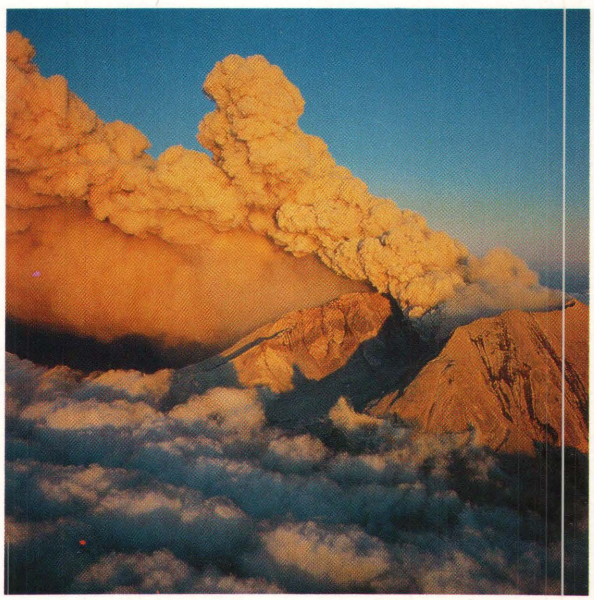


Volcanic Eruptions of 1980 at Mount St. Helens

The First 100 Days

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1249



Volcanic Eruptions of 1980 at Mount St. Helens

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Photographs of Mount St. Helens after (top) and before (bottom) the May 18, 1980, eruption, taken from exactly the same spot at Coldwater II observation station, 5.7 miles north-northwest of the peak. Haze in the top view is mostly airborne volcanic ash, which is present near the volcano during all but the calmest (or rainy) days. These photographs were taken by Harry Glicken on May 17 and September 10, 1980.

Volcanic Eruptions of 1980 at Mount St. Helens

The First 100 Days

By BRUCE L. FOXWORTHY *and* MARY HILL

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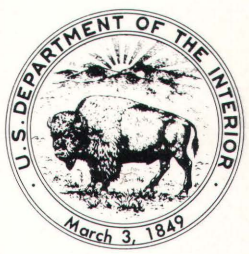


UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1982

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, *Secretary*

GEOLOGICAL SURVEY

Dallas L. Peck, *Director*

Library of Congress Cataloging in Publication Data

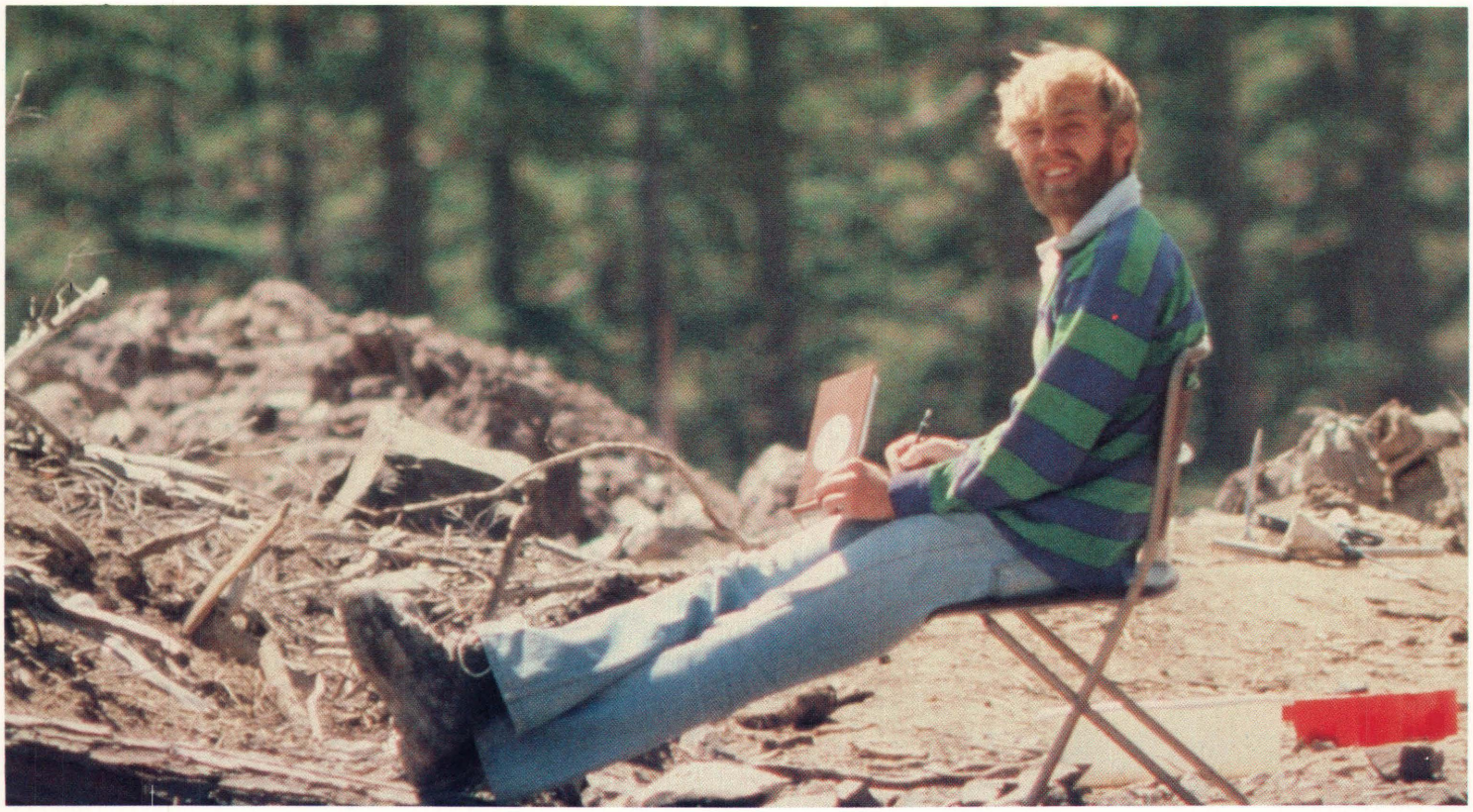
Foxworthy, B. L. (Bruce LaVerne), 1925–
Volcanic eruptions of 1980 at Mount St. Helens.

(Geological Survey professional paper ; 1249)
Bibliography: p.
Supt. of Docs. no.: I 19.16:1249
1. Saint Helens, Mount (Wash.)—Eruption, 1980. I. Hill, Mary, 1923– . II. Title. III. Series.
QE523.S23F69 1982 551.2'1'0979784 82-600231

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

IN DEDICATION

DAVID A. JOHNSTON
DECEMBER 1949–MAY 1980



Volcanologist David A. Johnston writing field notes at Coldwater II observation station May 17, 1980, the evening before he was killed by the lateral blast of the Mount St. Helens eruption. Earlier in the day, Johnston had collected volcanic gas samples from a fumarole high on the unstable northern side of the volcano (see fig. 20.). This photograph was taken by Harry Glicken, who was relieved of his observer duties at Coldwater II by Johnston and who brought this film out of the area the night before the fatal eruption.

Among those who lost their lives in the May 18, 1980, eruption of Mount St. Helens was an exceptional colleague, volcanologist David Johnston.

David was special not only because he was the first member of the U.S. Geological Survey to die in a volcanic eruption but also because of his capabilities and his dedication to his science. He knew well the personal risks involved in studying active volcanoes. Yet, his belief in the need to better understand volcano behavior led him to vigorous service in the "front lines" at Mount St. Helens. Through it all, he displayed a rare combination of inventiveness and originality in his scientific observations and interpretations.

On the morning of May 18, David was alone at the Coldwater II observation station, 5.7 miles from the mountain's summit, measuring the volcano's bulging northern side. He was among the first to see the beginning of the eruption and tried to send a warning to the control center. "Vancouver, Vancouver, this is it!," he shouted into his radio. Then, as the black, billowing front of the lateral blast raced toward him, he tried a second message, which was garbled by atmospheric disturbance from the eruption. Then—nothing.

The lateral blast obliterated Coldwater II observation station. Ironically, the location was (and is again) considered to be much safer than some of the sites on the mountain itself that David and his colleagues visited regularly.

We dedicate this report to David Johnston, an untimely loss to his science as well as to his friends.

PREFACE

This report is unusual for the U.S. Geological Survey's Professional Paper series. Not only does it attempt to describe volcanic events that are unprecedented in United States history, it also tries to describe those events in ways that the nontechnical reader will understand and in a context of human concerns to which he can relate. This account will serve as a backdrop for more technically written scientific reports on the volcanic activity at Mount St. Helens and the geologic and hydrologic effects of its eruptions.

Because this report is intended for a broad audience consisting mainly of nonscientists, we have avoided technical language wherever it was possible. Discussions of the volcanic processes and related hazards, however, touch upon many scientific specialties and involve some terms and concepts for which nontechnical counterparts simply do not exist. Some of these technical terms are explained when they are used in the main body of the report, and some are defined in a glossary at the back of the report (p. 121). A term that is explained in the glossary appears in bold italicized type the first time that it is used in the text.

Similarly, we have used mostly English units of measurement (inches, feet, miles, and so forth) rather than metric units for presenting quantitative information. Exceptions include altitudes and contour intervals (given in meters) on one of the general maps (fig. 7) and ash thicknesses (given in millimeters) on the ash-distribution maps (figs. 35, 43, and 48). Temperatures are given in both Fahrenheit and Celsius units. A table for converting other units to the metric system is provided at the back of the report (p. 125).

Although the words in this report are largely ours, most of the information comes from the work of many others. These information sources range from scientific publications prepared years before the 1980 eruptions to oral accounts, news releases, and data obtained after the major eruptions. It is impossible to present appropriate and balanced credits for all information and materials used; generally we have cited only the more readily indentifiable sources, such as photographers (in photographic credits) and published reports (listed in the reference section).

Among the sources that can be identified are the daily, summary, and hazard reports prepared by the leaders of the U.S. Geological Survey's Mount St. Helens task force—Robert L. Christiansen, Dwight R. Crandell, Robert W. Decker, Donal R. Mullineaux, and Donald W. Petersen—and by the leader of the University of Washington seismology center, Stephen D. Malone. We also have borrowed freely from U.S. Geological Survey press releases prepared by Donovan Kelly, Edna C. King, and Donald R. Finley. With permission, we have quoted the eyewitness account provided by Keith L. Stoffel, first published in Information Circular 71 of the Washington Department of Natural Resources, Division of Geology and Earth Resources (Korosec and others, 1980). Many other eyewitness accounts and observations by both scientists and nonscientists are quoted or paraphrased.

Christiansen provided us with a typescript copy of a paper published in *Nature* (June 19, 1980) (Christiansen, 1980). We made extensive use of it and of monthly reports prepared by many scientists on the U.S. Geological Survey–University of Washington team. We also have quoted from *Potential Hazards from Future Eruptions of Mount St. Helens Volcano, Washington*, published as U.S. Geological Survey Bulletin 1383–C (Crandell and Mullineaux, 1978). The "Glossary of Volcanic and Related Terms" (p. 121) is derived largely from a glossary prepared by Roy A. Bailey.

Although most of the technical information for this report was provided by colleagues in the U.S. Geological Survey, other individuals and agencies also provided valuable information. Malone furnished summary data on seismic events recorded by the University of Washington Geophysics Program. We used information selectively from bulletins prepared by the Mount St. Helens Technical Information Network; other information was taken from daily reports and news releases of the U.S. Forest Service, the U.S. Army Corps of Engineers, and the Federal Emergency Management Agency. For the human side of the volcanic events, we relied on the news media and a few personal interviews.

Photographs used to depict various events or features discussed in the text were selected, insofar as it was practical, to reflect the first occurrence or discussion of the specific event or feature. Better illustrations of several subjects, however, are provided by photographs that were not strictly equivalent in time. Other illustrations are enhanced by paintings by U.S. Geological Survey hydrologist-artist Dee Molenaar.

Technical reviews of part or all of this report were provided by Mullineaux, Peterson, Crandell, Molenaar, David G. Frank, David P. Dethier, Philip J. Carpenter, Edwin H. McGavock, John E. Cummans, Mark L. Holmes, and Jerry C. Stephens of the U.S. Geological Survey; Malone of the University of Washington Geophysics Program; James L. Unterwegner of the U.S. Forest Service; and geologists Vaughn E. Livingston, Jr., J. Eric Schuster, and Michael A. Korosec of the Washington Department of Natural Resources, Division of Geology and Earth Resources. Individual credits for the many other scientists, graphics specialists, and reviewers who contributed to this report are impractical, but the helpful cooperation of all is most gratefully acknowledged.

Finally, we wish to acknowledge the key role played by David A. Rickert, assistant to the Chief Hydrologist of the U.S. Geological Survey, who developed the concept for this report and provided encouragement and many helpful suggestions during its preparation.

Bruce L. Foxworthy

Mary Hill

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