

FLOODS, FAULTS, and FIRE

Geological Field Trips in Washington State and Southwest British Columbia

Edited by Pete Stelling and David S. Tucker



Field Guide 9



THE GEOLOGICAL SOCIETY
OF AMERICA®

*Floods, Faults, and Fire: Geological Field Trips in
Washington State and Southwest British Columbia*

edited by

Pete Stelling
Geology Department
Western Washington University
516 High St., MS 9080
Bellingham, Washington 98225
USA

David S. Tucker
Geology Department
Western Washington University
516 High St., MS 9080
Bellingham, Washington 98225
USA



THE
GEOLOGICAL
SOCIETY
OF AMERICA®

Field Guide 9

3300 Penrose Place, P.O. Box 9140 ■ Boulder, Colorado 80301-9140 USA

2007

Copyright © 2007, The Geological Society of America, Inc. (GSA). All rights reserved. GSA grants permission to individual scientists to make unlimited photocopies of one or more items from this volume for noncommercial purposes advancing science or education, including classroom use. For permission to make photocopies of any item in this volume for other noncommercial, nonprofit purposes, contact the Geological Society of America. Written permission is required from GSA for all other forms of capture or reproduction of any item in the volume including, but not limited to, all types of electronic or digital scanning or other digital or manual transformation of articles or any portion thereof, such as abstracts, into computer-readable and/or transmittable form for personal or corporate use, either noncommercial or commercial, for-profit or otherwise. Send permission requests to GSA Copyright Permissions, 3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301-9140, USA.

Copyright is not claimed on any material prepared wholly by government employees within the scope of their employment.

Published by The Geological Society of America, Inc.
3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301-9140, USA
www.geosociety.org

Printed in U.S.A.

Library of Congress Cataloging-in-Publication Data

Floods, faults, and fire : geological field trips in Washington State and southwest British Columbia / edited by Pete Stelling, David S. Tucker.

p. cm. -- (Field guide ; 9)

Includes bibliographical references.

ISBN 978-0-8137-0009-0 (pbk. : alk. paper) 1. Geology--Washington (State) 2. Geology--British Columbia. I. Stelling, Peter L. II. Tucker, David S. (David Samuel)

QE175.F57 2007

557.97--dc22

2007005929

Cover: The Fairhaven district of Bellingham, Washington, site of the 2007 GSA Cordilleran Section Meeting, sits on Bellingham Bay, east of the San Juan Islands in the Strait of Georgia. In this view looking east, heavily glaciated Mount Baker volcano (3286 m, 10,781 ft) rises above the Cascade Range foothills 50 km away. Steam plumes are often seen from the town in winter, rising above the active vent at Sherman Crater in the notch just right (south) of the summit. Glacially eroded remnants of the Middle Pleistocene Black Buttes stratocone, a predecessor to Mount Baker, form the rugged peaks on Baker's west flank, just below the summit cone in this view. At far right are the northern peaks of the Twin Sisters Range, a 12-km-long dunite mantle wedge emplaced by faulting, among the largest of its kind in the world. The highest peak, South Twin, is ~2135 m (7000 ft) and only 28 km from the sea at Bellingham. Forested hills in the foreground are underlain by fluvial sandstone, shale and conglomerate of the Eocene Chuckanut Formation. Field trips in this guidebook visiting Mount Baker and the surrounding area are Tucker et al., Mustoe et al., Linneman et al., Easterbrook et al., and Riedel. Two trips visit the nearby San Juan archipelago: Blake and Engebretson, and Brown et al. Aerial photo by John Scurlock.

Contents

<i>Preface</i>	v
1. Canadian Cascade volcanism: Subglacial to explosive eruptions along the Sea to Sky Corridor, British Columbia	1
J.K. Russell, C.J. Hickson, and G. Andrews	
2. New developments in Late Pleistocene and Holocene glaciation and volcanism in the Fraser Lowland and North Cascades, Washington	31
D.J. Easterbrook, D.J. Kovanen, and O. Slaymaker	
3. Early Fraser glacial history of the Skagit valley, Washington	57
J.L. Riedel	
4. Field guide to Mount Baker volcanic deposits in the Baker River valley: Nineteenth century lahars, tephra, debris avalanches, and early Holocene subaqueous lava	83
D.S. Tucker, K.M. Scott, and D.R. Lewis	
5. Lively landscapes: Major Holocene geomorphic events in the Nooksack–Sumas Valley	99
S. Linneman, P. Pittman, and L. Vaugeois	
6. Geology and paleontology of the early Tertiary Chuckanut Formation	121
G.E. Mustoe, R.M. Dillhoff, and T.A. Dillhoff	
7. Murrelets and molasse in the eastern San Juan Islands	137
C. Blake and D. Engebretson	
8. Tectonic evolution of the San Juan Islands thrust system, Washington	143
E.H. Brown, B.A. Housen, and E.R. Schermer	
9. Regional Tertiary sequence stratigraphy and structure on the eastern flank of the central Cascade Range, Washington	179
E.S. Cheney and N.W. Hayman	
10. Flood basalts and Ice Age floods: Repeated late Cenozoic cataclysms of southeastern Washington	209
B.N. Bjornstad, R.S. Babcock, and G.V. Last	

Preface

This volume contains guides to ten geological field trips offered during the May 2007 GSA Cordilleran Section meeting held at Western Washington University in Bellingham, Washington. The trips presented in this volume sample some of the geologist's paradise found in Washington State and British Columbia (Fig. 1). The region visited in the various trips hosts a wide variety of geologic and geographic terranes, from the dry scrub steppe of the channelled scablands and Columbia River basalt group in the east, across the glaciated and forested Cascade arc and Coast Mountains in the center, to the rain-shadowed, geologically complex islands in the west. We are particularly pleased that a preponderance of these trips highlights the geology in the immediate vicinity of Bellingham.

The guides are for the most part written so that people who are not present on the guided trips can enjoy the geology on their own. This guidebook may be unique because four of the trips (Blake and Engebretson, Russell et al., Brown et al., and Riedel) require boats to reach field areas that are difficult to access in any other way and are therefore rarely visited by geologists.

All of the guides in this volume have been reviewed. We hope the result provides thought-provoking interpretations of fascinating geology and an entertaining, useful volume. We thank the volunteers who have worked so hard to study, prepare, and submit these field trips, and those outside the editorial committee who reviewed them. We especially thank Ned Brown, emeritus professor at Western, who worked with the editors to solicit and organize these field trips, and provide needed guidance for us.

Pete Stelling
David S. Tucker

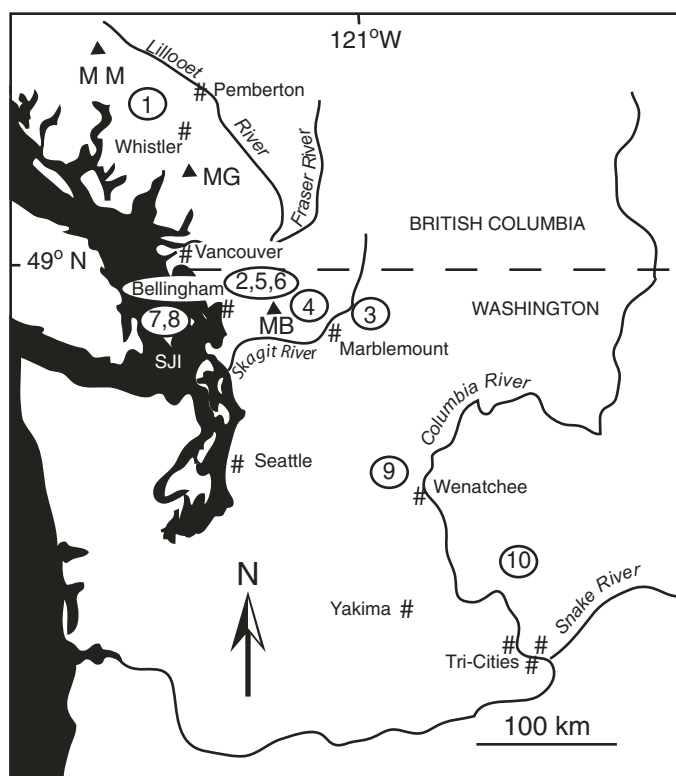


Figure 1. Areas visited by the field trips in this guidebook are shown in circled numbers on the map. Trips are: 1—Southwestern British Columbia volcanism (Russell et al.); 2—Glaciation and volcanism in the Nooksack drainage (Easterbrook et al.); 3—Skagit River Pleistocene glaciation (Riedel); 4—Mount Baker volcanics (Tucker et al.); 5—Geomorphic events in the Nooksack valley (Linneman et al.); 6—Paleobotany of the Chuckanut Sandstone (Mustoe et al.); 7—Sucia Island geology and birding (Clark and Engebretson); 8—Structure and tectonics of the San Juan Islands (Brown et al.); 9—Eastern flank of the Central Cascades (Cheney and Hayman); and 10—Columbia River Basalt and Ice age floods (Bjornstad et al.). Abbreviations: MM—Mount Meager; MG—Mount Garibaldi; MB—Mount Baker.

