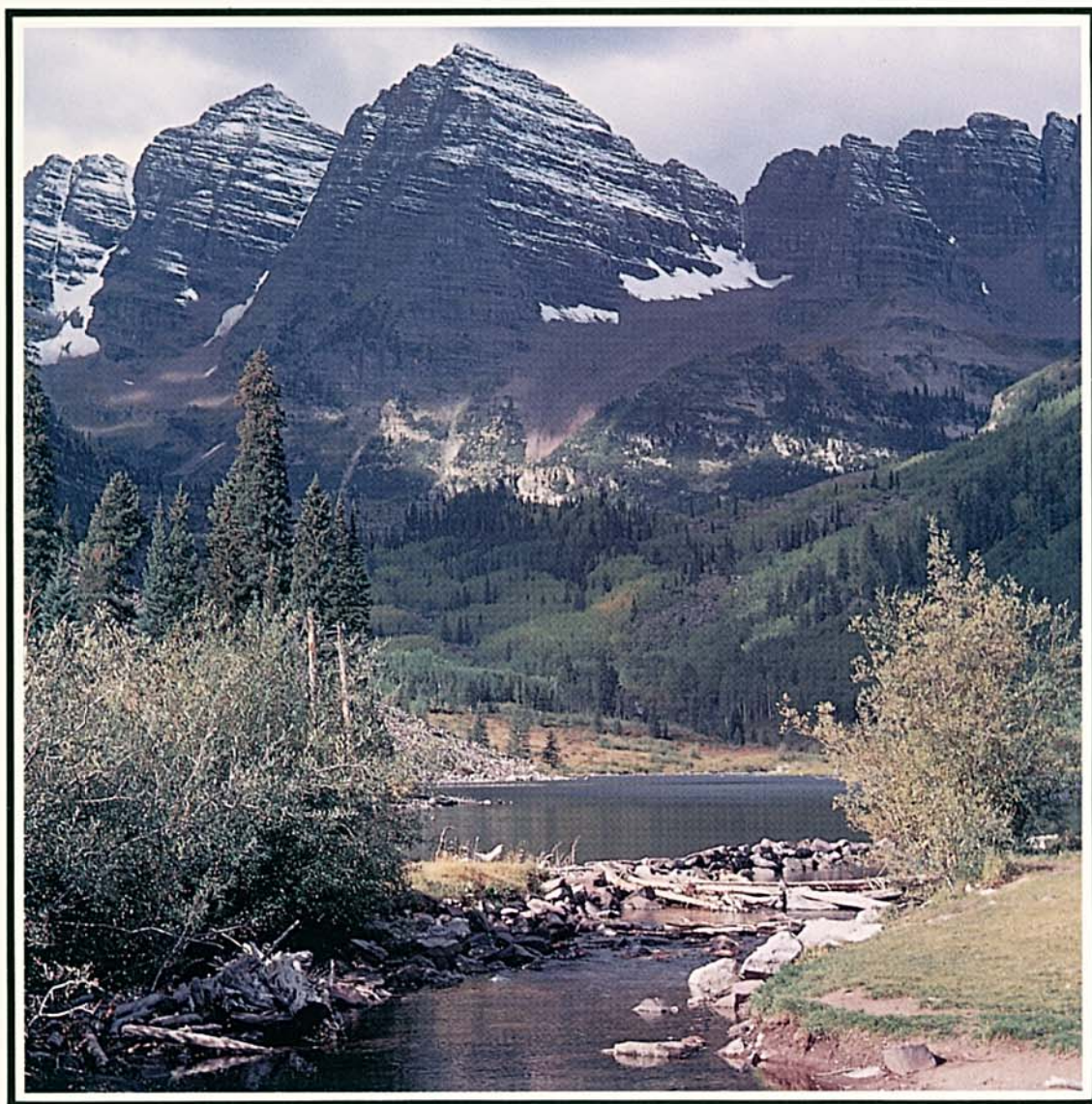


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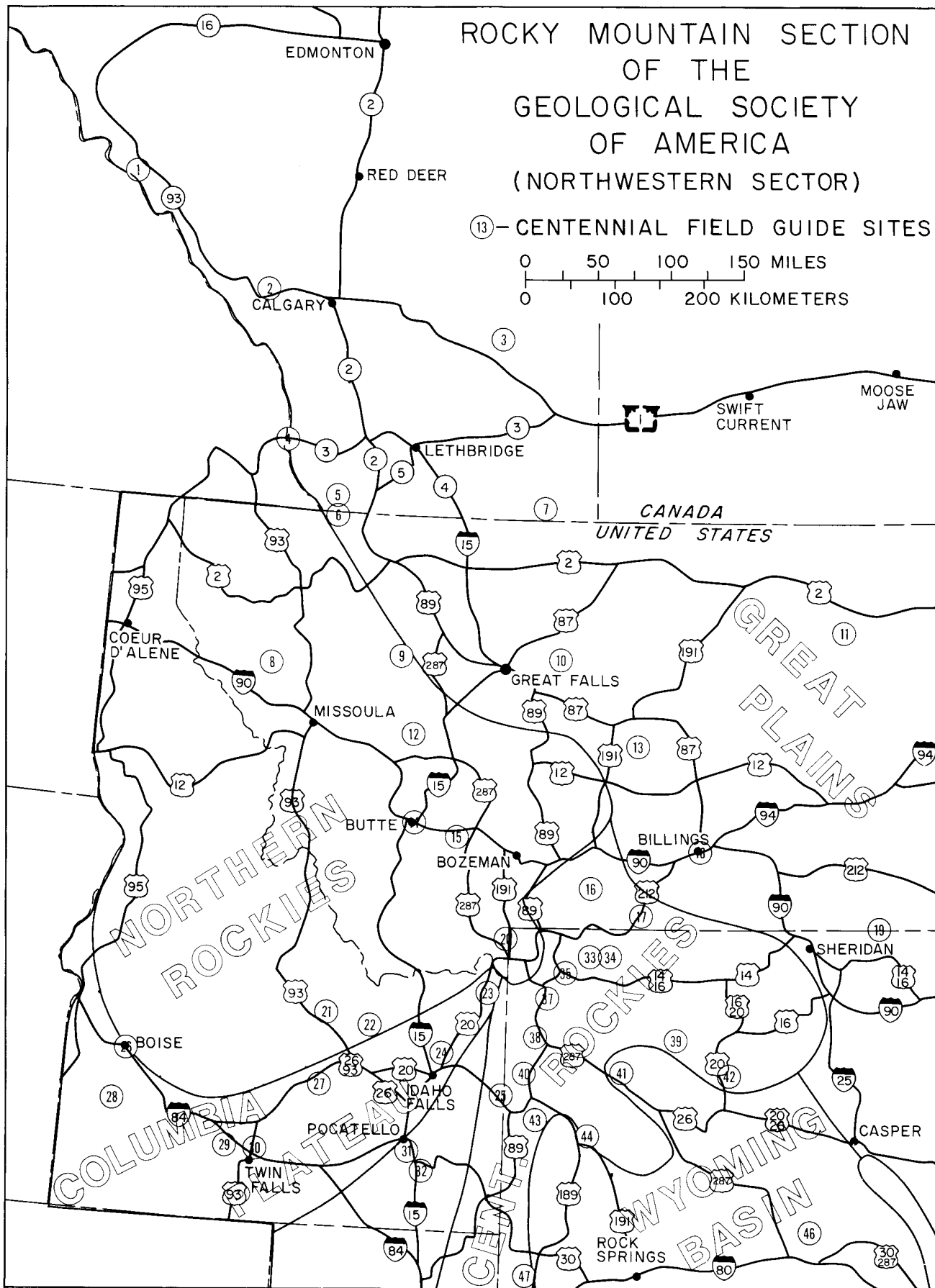
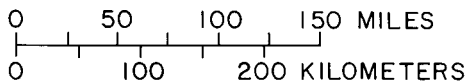


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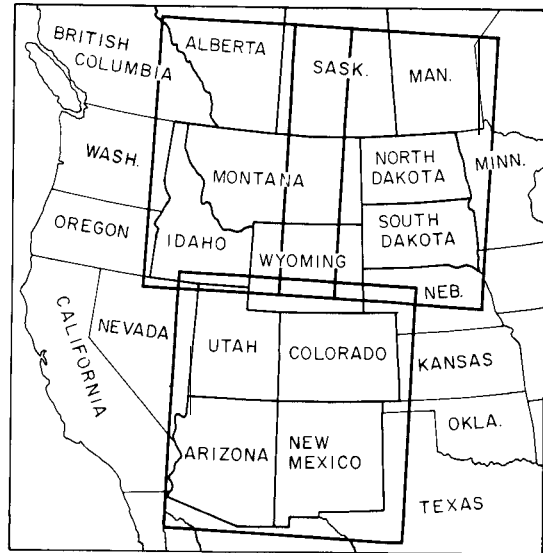
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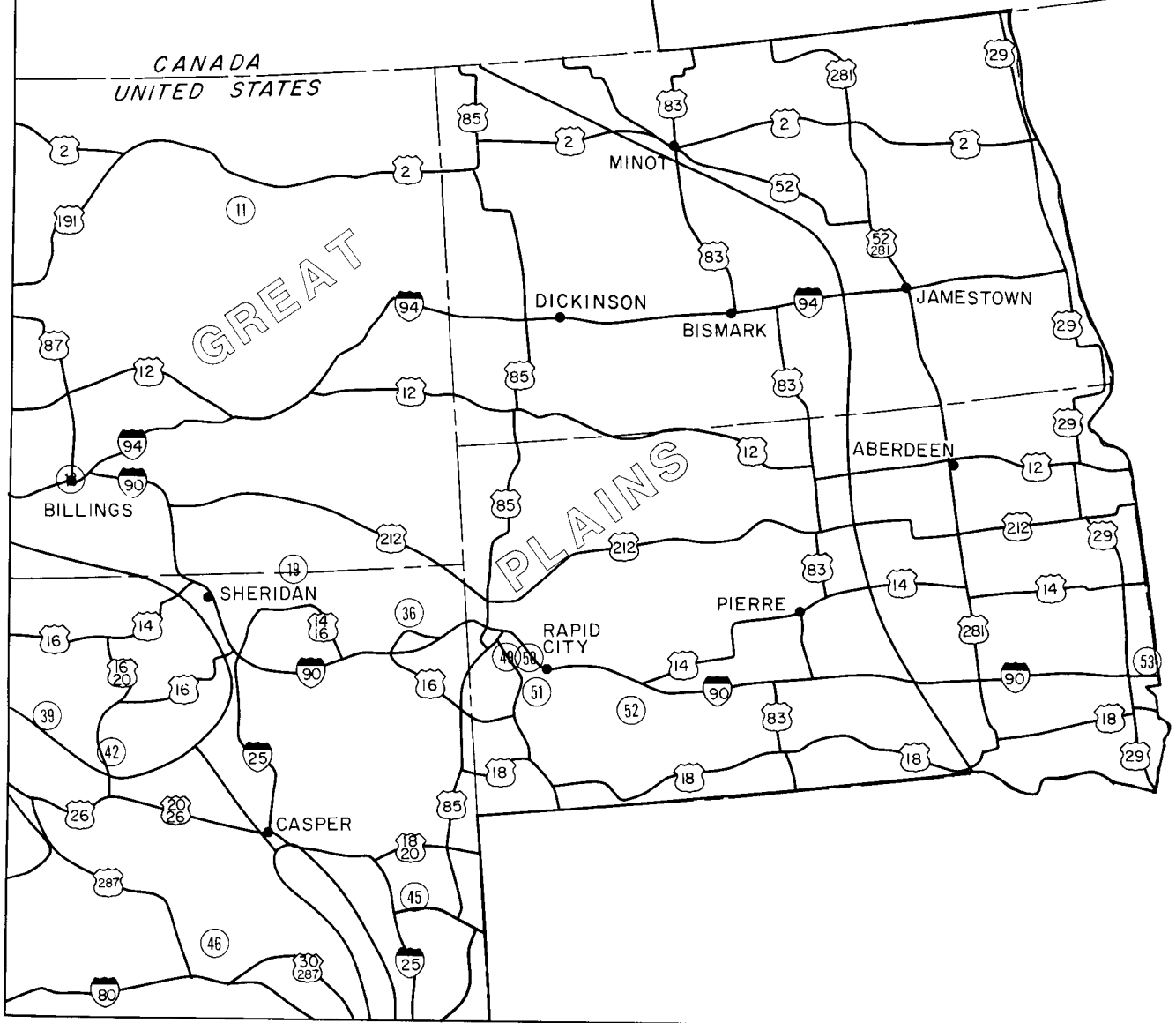
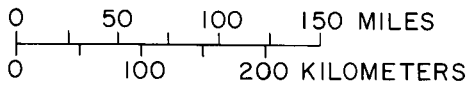
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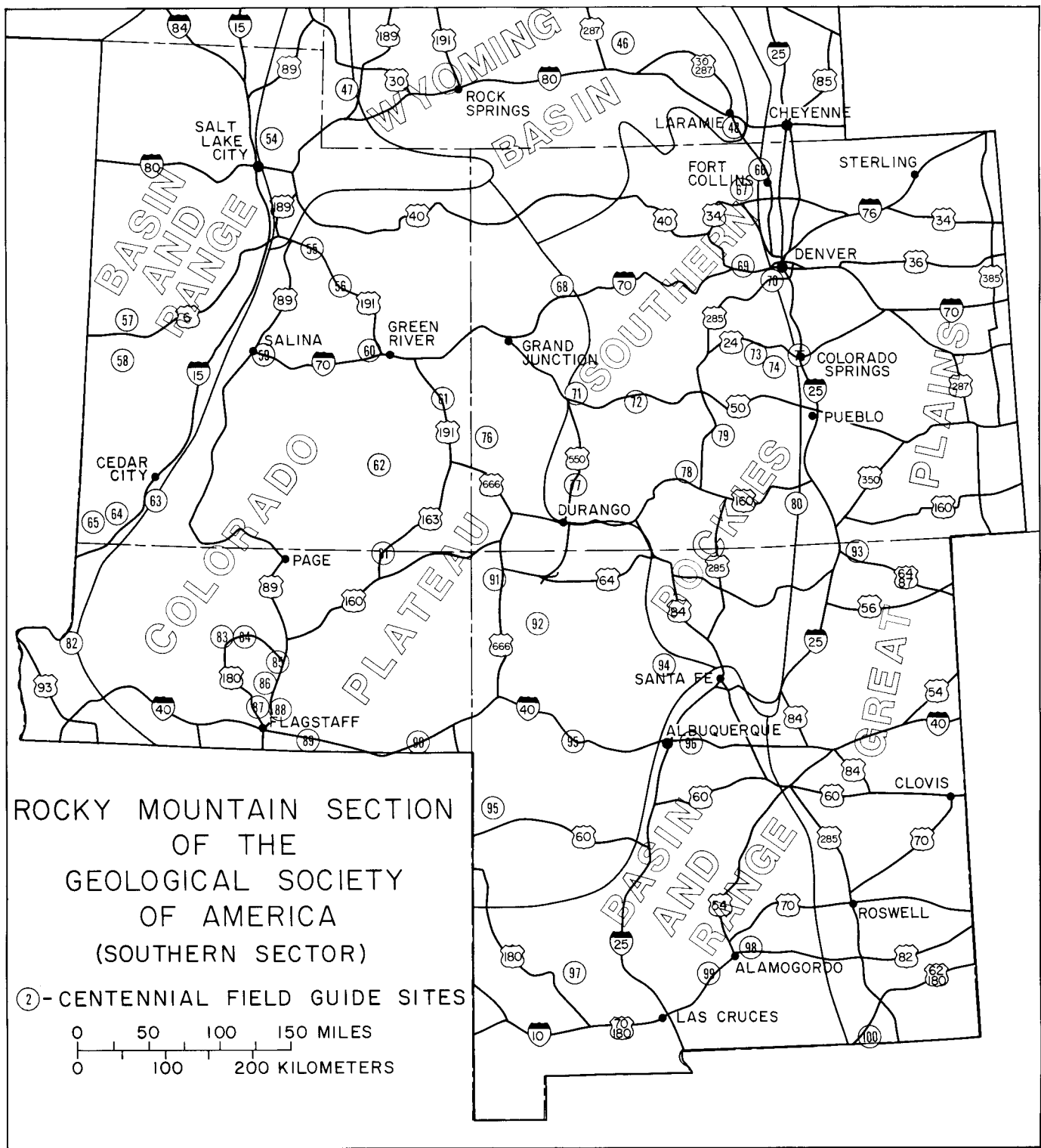


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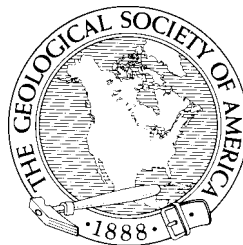


Centennial Field Guide Volume 2

***Rocky Mountain Section
of the
Geological Society of America***

Edited by

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1987

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Preface

This volume is one of a six-volume set of Centennial Field Guides prepared under the auspices of the regional Sections of the Society as a part of the Decade of North American Geology (DNAG) Project. The intent of this volume is to highlight, for the geologic traveler and for students and professional geologists interested in major geologic features of regional significance, 100 of the best and most accessible geologic localities in the area of the Rocky Mountain Section. The leadership provided by the editor, Stanley S. Beus, and the support provided to him by the Rocky Mountain Section of the Geological Society of America and the Department of Geology of Northern Arizona University are greatly appreciated.

Drafting services were offered by the DNAG Project to those authors of field guide texts who did not have access to drafting facilities. Particular thanks are given here to Ms. Karen Canfield of Louisville, Colorado, who prepared final drafted copy of many figures from copy provided by the authors.

In addition to Centennial Field Guides, the DNAG Project includes a 29-volume set of syntheses that constitute *The Geology of North America*, and 8 wall maps at a scale of 1:5,000,000 that summarize the geology, tectonics, magnetic and gravity anomaly patterns, regional stress fields, thermal aspects, seismicity, and neotectonics of North America and its surroundings. Together, the synthesis volumes and maps are the first coordinated effort to integrate all available knowledge about the geology and geophysics of a crustal plate on a regional scale. They are supplemented, as a part of the DNAG project, by 23 Continent–Ocean Transects providing strip maps and both geologic and tectonic cross sections strategically sited around the margins of the continent, and by several related topical volumes.

The products of the DNAG Project have been prepared as a part of the celebration of the Centennial of the Geological Society of America. They present the state of knowledge of the geology and geophysics of North America in the 1980s, and they point the way toward work to be done in the decades ahead.

Allison R. Palmer
Centennial Science Program Coordinator

Foreword

The Rocky Mountain Section of the Geological Society of America encompasses the intermountain states of Montana, Idaho, Wyoming, Utah, Colorado, and New Mexico as well as the northern third of Arizona, the Dakotas, and the Canadian provinces of Alberta and Saskatchewan. This region includes much of the mountain crest of the continent, plus adjacent parts of the Basin and Range, plateaus to the west and south, and the high plains to the east. A number of important geologic concepts were either first recognized or greatly amplified here by the pioneer geologists of the last century. G. K. Gilbert, a member of an early survey party of this region in the nineteenth century, was the first to recognize laccoliths and extensive block faulted mountains. J. Wesley Powell was the first to traverse the canyons of the Colorado River by boat and first defined the concept of antecedent streams,

Some areas in this region have received intense geologic scrutiny, particularly those near important mining sites or fossil fuel localities and near major universities. Other parts of the region are sufficiently remote to have been only slightly studied. There remain many challenging and stimulating geologic problems to be pursued.

The original editorial committee for this field guide included Donald L. Smith, Montana State University; Kenneth Kolm, Colorado School of Mines; J. Keith Rigby, Brigham Young University in Utah; and myself, as editor. Midway through the project, Don Smith was tragically killed in an accident. His place on the committee was filled by Stephan G. Custer, Montana State University. The selection of the sites to be included, the obtaining of reviews, and the preliminary editing were done by all five members of the committee. However, I accept responsibility for the final editing and any errors that may have been missed. A great debt of appreciation is owed to the other four members of the editorial committee for their generous service in organizing this field guide. They have also each written one or more site descriptions for the book.

The charge given the editorial committee by the Management Board of the Section in 1983 was to select the 100 geologic sites that best display significant and instructive aspects of Rocky Mountain Section regional geology and/or unique examples of basic geologic concepts. Site nominations were solicited by a mailed invitation to all GSA members of the section and also by announcements at annual section meetings and correspondence with colleagues in industry, educational, and state and federal institutions throughout the Section. The editorial committee then invited others familiar with the local geology of the various regions to assist in selecting the 100 most appropriate sites from the more than 300 originally nominated. An attempt, only partially successful, was made to achieve a regional and topical balance of sites. In some cases, site descriptions from areas not originally nominated were actively solicited. Even so, the northeastern region of the section is not as well represented as

the rest, owing in part to lack of nominations and the withdrawal of some sites originally selected.

The topical distribution of sites is more balanced and covers a wide spectrum of features. It was agreed by the editorial committee, as initially suggested by GSA guidelines, to avoid sites that were of interest chiefly for mineral or fossil collections. However, several sites are included wherein fossils of biostratigraphic significance or minerals occur as unique examples of mineralization processes. One site of an impact crater having both earthly and extraterrestrial significance is included.

The geographic and topical distribution of sites is summarized in Table 1. Geographical arrangement is both by state or province and physiographic province. A number of sites include strata from more than one erathem or major features of more than one type; they have multiple entries in the table.

The limitation to 100 localities in such a vast and varied region necessitated omission of many significant sites. No doubt some will find a favorite site not included. It is hoped that the site descriptions contained here will provide a useful introduction for students and professionals to the regional geology. It is recognized that many of the localities described here are treated in local or regional guidebooks or other older literature. However, many of these references are either out of print or not conveniently available, particularly to those traveling through this region for the first time.

The site descriptions are arranged and numbered in groups by state or province beginning in the north, and generally from north to south within a state or province. Each site description includes an index map of the locality, access information, significance of the site, and description of features to be observed. The reference list at the end of each description was purposely limited to the most appropriate citations. The references within these citations provide a more complete bibliography. At some sites all the geologic features are available at a single location, but in many a series of separate stations, or observation viewpoints, is included in the site description. Most sites are located along or near a road, but some require major traverses on foot. Several localities wherein two or more closely related or closely spaced features occur are treated as double sites, as at Yellowstone, Grand Canyon, the Black Hills, and Heart Mountain, Wyoming. Many of the sites are on federal or state lands and are thus readily open to the public. Sites on private land may require permission to visit as indicated in individual site descriptions. At some sites, collecting or extensive hammering on the rocks may be permissible. At others, particularly on private land, such activities may be neither necessary nor appropriate and are expressly prohibited in national, provincial, or state parks or monuments.

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