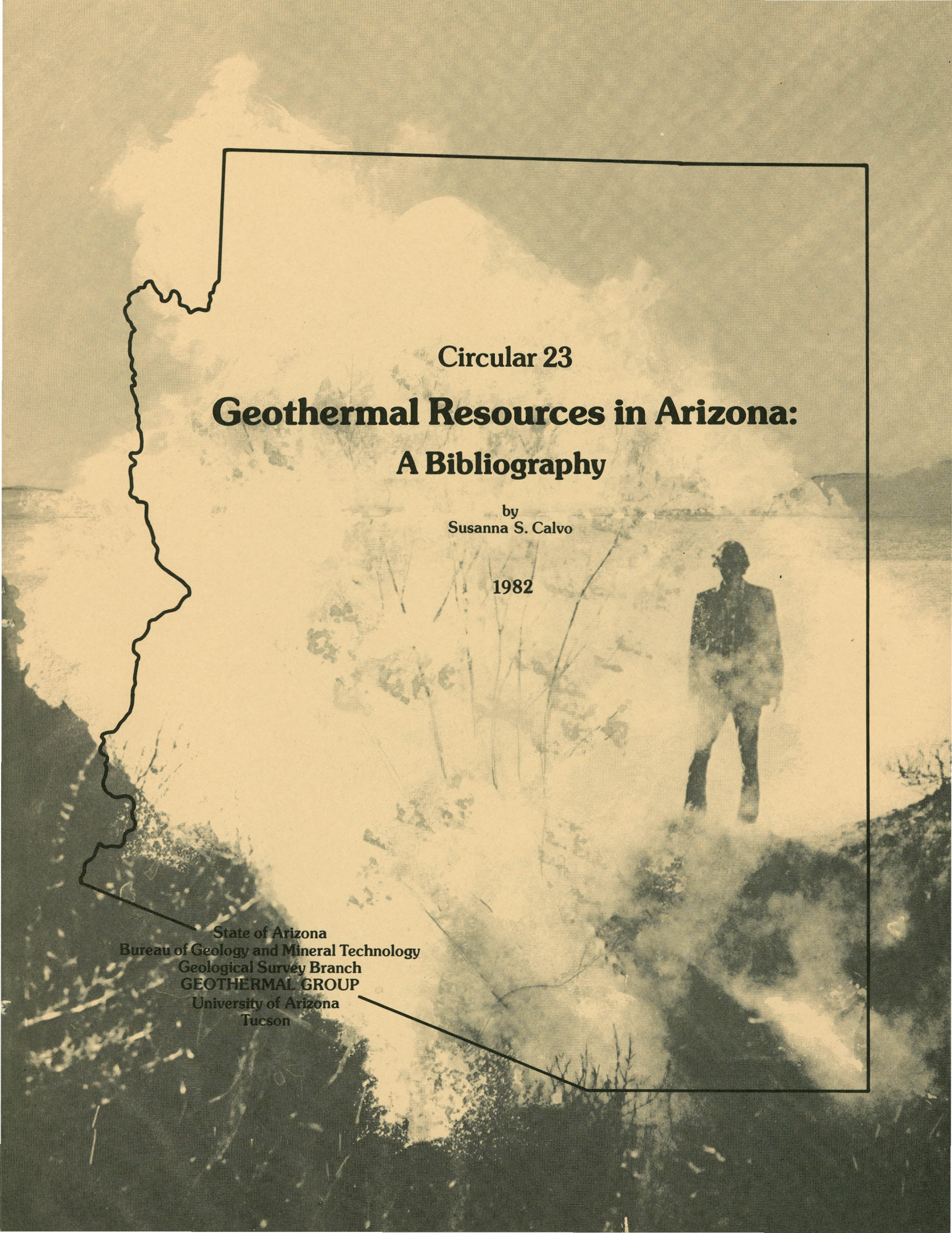

Circular 23

Geothermal Resources in Arizona: A Bibliography

by
Susanna S. Calvo

1982

State of Arizona
Bureau of Geology and Mineral Technology
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INTRODUCTION

Since 1977 considerable work has been accomplished in order to locate, understand and evaluate geothermal resources in the State of Arizona. Much of this work has been performed by Geothermal Project geologists of the State of Arizona Bureau of Geology and Mineral Technology. Additional reports addressing problems associated with geothermal development were produced by the Arizona Geothermal Commercialization Team of the Department of Chemical Engineering, University of Arizona. This bibliography references all reports and maps generated by these two groups. In addition, to provide a more comprehensive listing of geothermal energy in Arizona, all available "geothermal" papers from other sources have been included, most of them written in the last few decades. Older reports dating back to 1867, on thermal waters and mineral springs of Arizona and the southwest U.S., also have been listed.

Papers authored by geologists of the Geothermal Project are primarily evaluations of the geothermal potential of specific sites. Reports prepared by the Commercialization Team evaluate the potential for geothermal-energy use in Arizona and cover legislative issues, financial feasibility, area development plans, technical applications for space heating and cooling, and mining and agricultural needs.

Additional references have been incorporated into the bibliography because they provide background in the technical disciplines that support geothermal-energy research in Arizona: geology, hydrology, geophysics and geochemistry. Certain of these publications highlight Arizona localities later explored for geothermal resources; others propose geologic and geophysical models for the occurrence of thermal waters in the deep, alluvium-filled basins of southern and western Arizona. Some papers use geologic, hydrologic and geophysical data to define basin structures and alluvial stratigraphy, which control the occurrence, volume and movement of thermal water. Geochemical studies of well and spring waters discuss water quality and provide estimates of maximum water temperatures at depth. Publications on the thermal characteristics and structure of the crust beneath both the Colorado Plateau and the Basin and Range physiographic provinces are listed because they contain heat flow and thermal gradient data. Much of the regional geothermal data has been summarized on two large-scale maps showing the resource potential of Arizona (References # 82 and # 220).

Finally, selected references on general geology and hydrology have been included in this bibliography because they contain original data on temperatures of well, springs and water quality.

The various types of publications included in this bibliography have been annotated by symbols, shown below under SYMBOL AND ABBREVIATION KEY.

Index headings under SUBJECT AND AREA INDEX group publications by subject and location. Although many cross-references are included, it is advisable to check all possible categories for papers pertinent to one's interests. Specific locations are listed by county (see map preceding INDEX).

Federal funding for the Geothermal Project of the State of Arizona Bureau of Geology and Mineral Technology was provided by the U.S. Department of Energy, Division of Geothermal Energy, and the U.S. Department of Interior, Bureau of Reclamation. The Arizona Geothermal Commercialization Team received funding from the U.S. Department of Energy, Division of Geothermal Energy, and project administration from the Arizona Solar Energy Commission.

The author gratefully acknowledges Claudia Stone for her guidance and support of this compilation; James C. Witcher and Larry A. Goldstone for suggesting many useful sources of information and providing critical review; and Anne Candea and Rhonda Bitterli for editorial assistance. Sincere appreciation is extended to Asalene Hill and Peggy Jackson for competent typing, Bette Holt for cover design and illustrations, and Joe LaVoie for layout.

SYMBOL AND ABBREVIATION KEY

Symbols:

4. Bold numeral indicates report on open-file at, or produced in conjunction with, the State of Arizona Bureau of Geology and Mineral Technology

(G) Geophysical study

(H) Report contains heat-flow and geothermal-gradient data

(O) Older publication, may contain incomplete or obsolete data

(T) Report contains some thermal well and spring data

Abbreviations:

AMS Army Map Service

HDR Hot dry rock

M.y. Million years

AVAILABILITY OF REPORTS AND MAPS

State of Arizona Bureau of Geology and Mineral Technology publications and open-file reports may be obtained or reviewed at 845 N. Park Ave., Tucson, Arizona 85719 (602/626-2733).

Arizona theses and dissertations are shelved in the libraries at:

University of Arizona, Tucson 85721 (602/626-0111)

Arizona State University, Tempe 85281 (602/965-5081)

Northern Arizona University, Flagstaff 86001 (602/523-9011)

Current compilations of graduate theses on Arizona geology are available from the Arizona Geological Society, P.O. Box 40952, Tucson, Arizona 85717 (Digests XII and XIII), and at the State of Arizona Bureau of Geology and Mineral Technology.

U.S. Geological Survey (U.S.G.S.) publications may be obtained at the following addresses:

Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (*texts*)

U.S.G.S., Western Distribution Branch, Box 25286, Federal Center, Denver, CO 80225 (*maps*)

U.S.G.S., Western Distribution Branch, Open-file Services Section, Box 25425, Federal Center, Denver, CO 80225 (*open-file reports*)

Other government documents may be obtained from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

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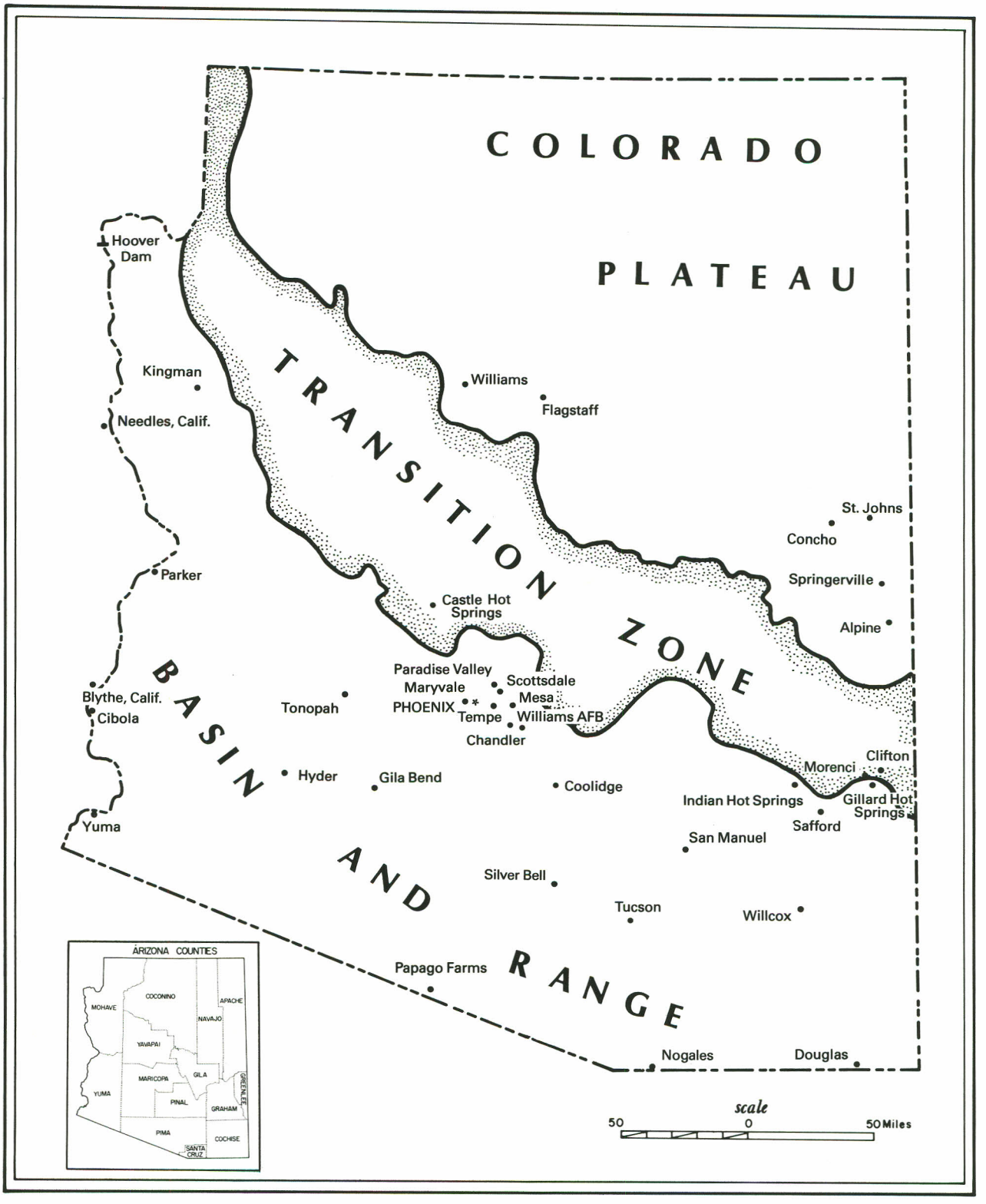
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TRANSITION ZONE
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Needles, Calif.
Parker
Blythe, Calif.
Cibola
Yuma
Williams
Flagstaff
St. Johns
Concho
Springerville
Alpine
Castle Hot Springs
Paradise Valley
Maryvale
Scottsdale
Mesa
PHOENIX
Tempe
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Indian Hot Springs
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Safford
San Manuel
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Tucson
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Papago Farms
Nogales
Douglas
ARIZONA COUNTIES
COCONINO
APACHE
MOHAVE
NAVAJO
YAVAPAI
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STATE OF ARIZONA
BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY

The Arizona Bureau of Geology and Mineral Technology was established in 1977 by an act of the State legislature. This act represents a reorganization of the Arizona Bureau of Mines which first was created in 1915 and placed under the authority of the Arizona Board of Regents. This authority has not changed. The Bureau continues its service in the fields of geology, metallurgy and mining in response to public inquiries, state agency requirements, and various research grants. In order to carry out these functions, two basic branches now are recognized:

The Geological Survey Branch is charged with the responsibility of acquiring, disseminating and applying basic geologic data that are designed to (a) enhance our understanding of Arizona's general geologic and mineralogic history and to assist in determining the short and long range influences these have on human activity, and (b) assist in developing an understanding of the controls influencing the locations of metallic, nonmetallic and mineral fuel resources in Arizona.

The Mineral Technology Branch conducts research and investigations into, and provides information about, the development of Arizona's mineral resources, including the mining,metallurgical processing and utilization of metallic and nonmetallic mineral deposits. These activities are directed toward the efficient and safe recovery of Arizona's mineral resources as well as insuring that recovery and treatment methods will be compatible with the basic environmental needs of the state.

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