CONTRIBUTIONS TO THE GOLD METALLOGENY OF NORTHERN NEVADA

Richard M. Tosdal
editor

Open-File Report

98-338

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, product or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

U.S. Geological Survey, Menlo Park, CA
Cover photographs: (Top) Raised relief map of northern Nevada showing the major belts of ore deposits, the Battle Mountain-Eureka mineral belt and the Carlin trend, in relation to the mid-Miocene northern Nevada rift along which hot-spring Au-Ag deposits are developed. Also shown are the interpreted distribution of basement types, based on Pb and Sr isotopic mapping, and the transition from intact Proterozoic and Archean crust on the east across thinned continental into regions floored by “oceanic crust” on the west. (Bottom) Photograph of gold-rich arsenian pyrite rims on older pyrite and arsenopyrite from the Getchell deposit. Arsenian pyrite-containing gold is typical of sedimentary-rock-hosted or Carlin-type deposits, the largest gold deposits, in Nevada.
# TABLE OF CONTENTS

Contributions to the gold metallogeny of northern Nevada—Preface  
*R.M. Tosdal* ................................................................................................................................. 1

## Crustal structure

Progress on understanding the crustal structure near the Battle Mountain-Eureka mineral trend from geophysical constraints  
*V.J.S. Grauch, D.P. Klein, Brian D. Rodriguez* ........................................................................... 8

Regional crustal structure beneath the Carlin Trend, Nevada, based on deep electrical geophysical measurements  
*Brian D. Rodriguez* ...................................................................................................................... 15

Pb isotopic mapping of crustal structure in the northern Great Basin and relationships to Au deposit trends  
*J.L. Wooden, R.W. Kistler, and R.M. Tosdal* ............................................................................... 20

Crustal structure and its relation to gold belts in north-central Nevada: Overview and progress report  
*V.J.S. Grauch* .................................................................................................................................. 34

## Carlin-type gold deposits

Preliminary facies analysis of Silurian and Devonian autochthonous rocks that host gold along the Carlin trend, Nevada  

Geology of the northern terminus of the Carlin trend, Nevada: Links between crustal shortening during the late Paleozoic Humboldt orogeny and northeast-striking faults  
*Ted G. Theodore, Augustus K. Armstrong, Anita G. Harris, Calvin H. Stevens, and Richard M. Tosdal* .................................................................................................................. 69

Evidence for the Crescent Valley-Independence Lineament, north-central Nevada  
*Stephen G. Peters* ......................................................................................................................... 106

Initial results of stratigraphic and structural framework studies in The Cedars quadrangle, southern Shoshone Range  
*Thomas E. Moore and Benita L. Murchey* .................................................................................. 119

Recognition and significance of Eocene deformation in the Alligator Ridge area, central Nevada  
*C.J. Nutt and S.C. Good* ................................................................................................................. 141

Tungsten-polymetallic- and barite-mineralized rocks in the Ruby Mountains, Nevada  
*Vladimir I. Berger and Robert L. Oscarson* .................................................................................. 151

Age and possible source of air-fall tuffs of the Miocene Carlin Formation, northern Carlin trend  
*Robert J. Fleck, Ted G. Theodore, Andrei Sarna-Wojcicki, and Charles E. Meyer* .................... 176

Importance of clay characterization to interpretation of \(^{40}\text{Ar}/^{39}\text{Ar}\) dates on illite from Carlin-type gold deposits: Insights from Jerritt Canyon, Nevada  
δD and δ\(^{18}\)O data from Carlin-type gold deposits—Implications for genetic models

*Albert H. Hofstra and Robert O. Rye* ................................................................................................................. 202

Geochemical modeling of alteration and gold deposition in the Betze deposit, Eureka County, Nevada

*M. B. Woitsekhowskaya and S.G. Peters* ............................................................................................................. 211

Mixed sources of Pb in sedimentary-rock-hosted Au deposits, northern Nevada


Regional analysis of the distribution of gold deposits in northeast Nevada using NURE arsenic and geophysical data

*Boris B. Kotlyar, Donald A. Singer, Robert C. Jachens, and Ted G. Theodore* .................................................... 234

Soil gas studies along Carlin trend, Eureka and Elko counties, Nevada

*Howard McCarthy and Emmet McGuire* ............................................................................................................. 243

### Pluton related gold deposits in the Battle Mountain Mining District

Pluton-related Au in the Battle Mountains Mining District—An overview

*Ted G. Theodore* .................................................................................................................................................. 251

Large distal-disseminated precious-metal deposits, Battle Mountain Mining District, Nevada

*Ted G. Theodore* .................................................................................................................................................. 253

Multilevel geochemical patterns at the Fortitude gold skarn, Battle Mountain Mining District, Nevada

*Boris B. Kotlyar and Ted G. Theodore* ................................................................................................................ 259

### Hot-spring Au deposits

New studies on Tertiary volcanic rocks and mineral deposits, northern Nevada Rift

*A.R. Wallace and D.A. John* ............................................................................................................................... 264

Geology and mineralization of the Eocene Tuscarora Volcanic Field, Elko County, Nevada

*Christopher D. Henry, David R. Boden, and Steven B. Castor* ........................................................................... 279
CONTRIBUTORS TO THIS VOLUME

U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Augusta K. Armstrong
Vladimir I. Berger
Boris B. Kotlyar
Robert J. Fleck
Robert C. Jachens
David A. John
Ronald W. Kistler
Charles E. Meyer
Thomas E. Moore
Benita L. Murchey
Robert L. Oscarson
Andrei Sarna-Wojcicki
Donald A. Singer
Ted G. Theodore
Richard M. Tosdal
Joseph L. Wooden

U.S. Geological Survey
Mackay School of Mines
University of Nevada
Reno, NV 89557

Howard McCarthy
Emmet McGuire
Stephen G. Peters
Alan R. Wallace

U.S. Geological Survey
Box 25046 Denver Federal Center
Denver, CO 80225

D.D. Eberl
Helen W. Folger
Carol. A Gent
V.J.S. Grauch
Albert H. Hofstra
Douglas P. Klein
Constance J. Nutt
Brian D. Rodriguez
Robert O. Rye
Lawrence W. Snee

U.S. Geological Survey
National Center
Reston, VA 22092

Anita G. Harris
OTHER CONTRIBUTORS

Earl W. Abbott
Consultant
Reno, NV 89502

Keith H. Bettles
Eric G. Lauha
Richard A. Hipsley
Gregory L. Griffin
Barrick Goldstrike Mines, Inc.
Elko, Nevada 89803

David R. Boden
1445 High Chaparral Drive
Reno, NV 89511

J. S. Cline
Department of Geoscience
University of Nevada, Las Vegas
Las Vegas, NV

J. Kelly Cluer
Uranerz U.S.A. Inc.
Reno, Nevada 89502

S.C. Good
Department of Geology and Astronomy
West Chester University
West Chester, PA. 19383

Christopher D. Henry
Steven B. Kastor
Nevada Bureau of Mines and Geology
University of Nevada
Reno, NV 89557

Calvin H. Stevens
Department of Geology
San Jose State University
San Jose, CA 95192

Michaela Young-Griffin
Department of Geosciences
University of Arizona
Tucson, AZ 85721

Maria B. Woitsekhowskaya
Mackay School of Mines
University of Nevada
Reno, NV 89557