

# Colorado Scientific Society

*In pursuit of the promotion of knowledge,  
the understanding of science,  
and its application to human needs.*

## ORIGIN OF DEVILS TOWER, WYOMING

by

Charles S. Robinson  
Mineral Systems, Inc.

Devils Tower is a conspicuous physiographic feature on the western flank of the Black Hills of Wyoming. Because of its striking appearance, it was established as the first National Monument in 1906. Its most striking feature is the columnar jointing, which has been used by most geologists to interpret the origin of the Tower.

The Tower is about 600 feet high, about 300 feet in maximum diameter at the top, and 800 feet in diameter at its base.

Devils Tower is composed of phonolite porphyry, and is one of a series of igneous intrusions of similar composition that intruded the sedimentary rocks of the western flank of the Black Hills 55 to 33 Ma. Exposed at the base of Devils Tower is the Sundance Formation of Jurassic age and in the vicinity of the Tower, are the Gypsum Spring Formation, of Middle Jurassic age, and the Spearfish Formation of Triassic age.

The origin of Devils Tower has been attributed to an igneous intrusion, or plug, that intruded the sedimentary rocks but did not reach the surface, to the remnant of a laccolith, and to the neck of an extinct volcano. The volcanic-neck origin is based primarily on a comparison of the columnar jointing of the Tower with the columnar jointing in volcanic necks exposed in the Mount Taylor volcanic field of New Mexico. The columnar jointing is the only similarity between the volcanic necks and Devils Tower. The volcanic necks are composed of basic rocks, basalt, basalt breccia, or andesite, showing considerable variation in mineralogy, texture, and structure within the same neck. They were vents for magma that repeatedly poured out to form many square miles of primarily basalt flows. In contrast, Devils Tower consists of phonolite porphyry, an intermediate to silicic rock, which, in general is homogeneous in mineralogy, texture, and structure. There is no evidence of extrusive igneous rock in the vicinity of Devils Tower, and at the time of the intrusion of Devils Tower (~50 Ma), the total stratigraphic section above the present level of the top of Devils Tower was approximately 7,000 feet. The White River Formation, younger than Devils Tower, does not include pyroclastic material.

Based on the regional and local geology, and the mineralogy, texture, and structure of Devils Tower, it is concluded that Devils Tower is the remnant of an igneous intrusion that did not breach the surface. The intrusive rock reached the level of the Lower Cretaceous shale where it expanded to an inverted teardrop shape, where it cooled and the columnar joints formed. The present Tower shape is the result of removal by erosion of the intruded, relatively soft, sedimentary rocks, and the weathering and erosion of the relatively hard, columnar jointed igneous rock of the Tower.

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## AVALANCHE SCIENCE: THE BASICS FOR AWARENESS AND FORECASTING

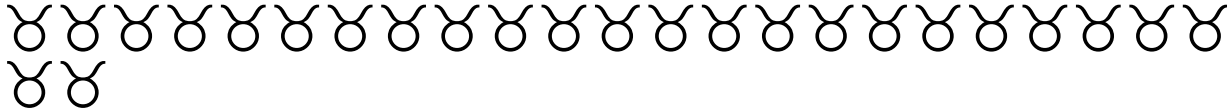
by

Knox Williams

Director of the Colorado Avalanche Information Center

Avalanche hazard forecasting is equal parts science and art. It involves a synthesis of terrain, weather, and snowpack factors. These are called the contributory factors to avalanche formation. I will focus on how a forecaster, or a back-country traveler, would gather and evaluate data to arrive at a forecast that would give a likelihood of avalanche release. Personal avalanche safety is directly related to probability of avalanche release, and the prudent back-country traveler possesses the knowledge, skills, and tools to eliminate or minimize his or her exposure to risk. This presentation will include a brief talk, followed by the viewing of a video on personal avalanche safety.

## Society Notes



### CANDIDATES FOR UPCOMING ELECTION

The Society will elect its officers for 1996-98 at the December 13 business meeting. Candidates for President-Elect and Councilors were recommended by the Nominating Committee. Paul Williams will continue in the office of Treasurer and the President will appoint a Secretary. In addition, this year we need to fill one partial term (1996-97) of Councilor.

If you can not attend the business meeting, please clip off the election ballot and return it to:

The Colorado Scientific Society  
P.O. Box 150495  
Lakewood, CO 80215-0495

### MAIL-IN BALLOT

President-Elect



Karl S. Kellogg



\_\_\_\_\_ (write in)

Councilors (vote for two) 1996-1998



Richard B. Wanty



James A. Cappa



\_\_\_\_\_ (write in)



\_\_\_\_\_ (write in)

Councilor (vote for one) 1996-1997



Lisa Ramirez Bader



\_\_\_\_\_ (write in)

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### RECRUITING NEW MEMBERS

In December we'll be sending out our Dues and Memorial Funds notices, however this month we would appreciate your help in recruiting new members. In this newsletter, you'll find an application form for new members, which do not require sponsorship. Even though we have publicity throughout Denver, don't underestimate the power of personal persuasion. Please make an effort to ask a couple of your friends, colleagues, or office mates if they would like to join. The dues are still modest\_\$5 for student, \$10 for corresponding, and \$15 for regular members.

## COUNCIL MEETING REPORT

The Council met on October 17, 1995 at the USGS office in Golden. The primary business of the meeting was to approve the recommendations of the Nomination Committee. The results are reported in the Ballot on page 3 of this Newsletter. I would like to thank Chairman Mike Machette, Dave MacKenzie, and Bob Weimer for their work on this Committee.

The financial status of the Society is sound and the Council has made the decision to begin to use income from the endowment to fund worthwhile projects. The current assets of the CSS are \$19,247.16. Expenses for the remainder of the year will include meeting room costs, airfare for our Family Night speaker, and other miscellaneous items. As reported in the last Newsletter, the CSS donated money to the Western Interior Paleontological Society for support of the volunteer excavation at Porcupine Cave. At this meeting, the Council voted to donate \$200.00 to the Colorado Avalanche Information Center (the snow people, not the hockey team!). The Director of the Center will be one of our speakers at the November 13 meeting.

Our membership remains healthy. The treasurer reported that we gained 17 new members since the beginning of the year. Currently 15 percent of the membership has not paid their 1995 dues, although we are doing a little better this year than last year at this time. Don't forget to renew your membership. There are very few organizations that are this inexpensive and provide as broad a geologic venue.

The fall field trip was canceled due to a very low registration. The Council is currently evaluating the concept of a two day fall trip, although we may just have an anomalous year. We will hope to offer this excellent geological opportunity again in the future. We appreciate the great work of the Field Trip Committee and Chairman Bob Reynolds and the enthusiasm of the field trip leaders.

Please remember to vote November 7 on the referendum on funding for the Scientific and Cultural Facilities District.

## FAMILY NIGHT

Dr. John H. Ostrom, Yale University, spoke on the dinosaur origin of birds to an audience of approximately 130 people on Wednesday, October 25. An excellent presentation was followed by an enthusiastic question and answer period. The talk was preceded by a Cretaceous buffet attended by sixty members, spouses, friends, and children in the Colorado School of Mines Museum. The Society would like to thank Ginny Mast, Director of the Museum, for facilitating arrangements for our speaker and dinner. We would also like to thank Theresa Smith, Aramark Food Service, for providing a wonderful tropical dinner buffet.

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### **New CSS member**

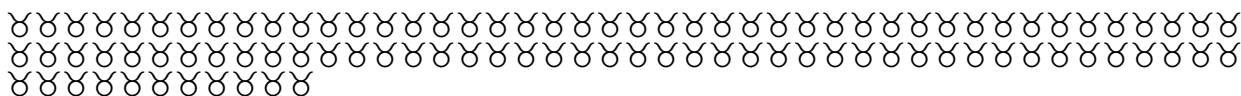
Welcome! Brian P. Menounos\_student, University of Colorado at Boulder

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## **Items for Newsletter**

We would like to include any items of general interest regarding members, new programs, scientific meetings, etc., in future newsletters. Please submit materials (hardcopies and/or computer disk) to Brad Van Gosen, USGS, Box 25046, M.S. 905, Denver Federal Center, Denver, CO 80225, or call (303-236-1566) or fax (303-236-5603). Please send items to the editor before the 20th of the month to ensure inclusion in the next newsletter.

## Earth Science Meetings



**Colorado Scientific Society.** The next regular meeting will be held on December 13, 1995, in the Colorado Mountain Club Auditorium, 710 10th St., Golden, Colorado. Social time is 7:00 p.m., meeting starts at 7:30 p.m.

This meeting will feature the Presidential Address and the Annual Business Meeting.

**Rocky Mountain Association of Geologists.** Regular meetings, normally held on the first and third Fridays of each month, consist of a luncheon at 11:55 a.m. and a lecture at 12:25 p.m. in the Bluebell Room of the Denver Petroleum Club in the Anaconda Towers, 555 17th St., downtown Denver. Cost of the luncheon is \$12. Reservations are taken on a recording line (303-623-5396) until 10:30 a.m. on the Wednesday before the luncheon. Reservations are **not** necessary to attend the talk only; however, there will be a \$2 charge at the door. Supply Information Center, Gas Research Institute, will give the presentation.

Nov. 3 "Laramide faulting and tectonics" by Eric Erslev, Associate Professor, Colorado State U.

Nov. 17 "The structural and stratigraphic evolution of the Perdido Foldbelt, Alaminos Canyon, northwestern deep Gulf of Mexico" by Paul Weimer, EMARC Director, University of Colorado.

Dec. 1 Annual Meeting and Professional Awards Presentation. The cost of the luncheon will be \$12.  
\*\*This will be the only luncheon held in December\*\*

**Denver International Petroleum Society ("D.I.P.S.").** Meetings held on 2nd Friday of the month at the Wynkoop Brewing Co., 18th and Wynkoop Streets, lower downtown Denver. Reception at 11:30 a.m., luncheon at 12:00, program at 12:30 p.m. Reservations required by calling RMAG recording line (303-623-5396). Reservations accepted after 2:00 p.m. on Friday and before 10:30 a.m. on Wednesday before the meeting. Cost: \$13 for lunch; talk only is available for \$2. Contact Keith Murray, 303-986-8554, for information.

Nov. 10 Glada Costales of the Natural Gas Research Institute, will give the presentation.

**Denver Mining Club.** All regular meetings are on Thursdays, from 11:30 a.m. to 1:00 p.m. at the Denver Federal Center, Building 41 Cafeteria (south entrance), Lakewood. For more information contact Doris Smith, Program Chairperson (303-456-5428).

Nov. 2 Celebrate their 104th Anniversary! Members who wish may contribute a 5 minute talk about interesting moments in their mining experience.

Nov. 9 "Saints or sinners: The history of Alferd Packer" by Julie Erickson Hendee, Erickson Monuments

Nov. 16 "The outlook for mining in Colorado" by Stuart Sanderson, President, Colorado Mining Assoc.

Nov. 23 Happy Thanksgiving. No meeting.

Nov. 30 "What's new at the Geology Museum" by Ginny Mast, Curator, Geology Museum, Colorado School of Mines

**Colorado School of Mines Department of Geology and Geological Engineering, Golden: Van Tuyl Lecture Series.**

Lectures are on Thursdays at 4:30 p.m. in Berthoud Hall, Room 108. Lectures are preceded by refreshments served at 4:00 p.m. and followed by a social hour in the Fireside Lounge at the Student Center. For further information, call Greg Holden (303-273-3855) or the Geology Department (303-273-3800).

Lectures are on Thursdays at 4:30 p.m. in Berthoud Hall, Room 108. Lectures are preceded by refreshments served at 4:00 p.m. and followed by a social hour in the Fireside Lounge at the Student Center. For further information, call Greg Holden (303-273-3855) or the Geology Department (303-273-3800).

Nov. 2 "Volcanic processes and massive sulphide formation" by Dr. Richard L. Stanton, SEG 1995 International Exchange Lecturer

Nov. 9 "The Mesel sedimentary rock-hosted gold deposit, north Sulawesi, and the Batu Hijau porphyry copper-gold deposit, Sumbawa Island, Indonesia" by Steve Turner, Colorado School of Mines

Nov. 16 "The Madden Field, A super-deep Madison dolomite gas reservoir" by Dr. Clyde Moore, Colorado School of Mines

**Association for Women Geoscientists.** New and prospective members are encouraged to find out more about AWG. For information contact Peggy Ganse, AWG President, 303-832-9636; fax 303-832-9616.

**Energy Environmental Studies, Dec. 6.**

Sponsored by the U.S. Geological Survey Center for Environmental Geochemistry & Geophysics. Denver Federal Center, Bldg. 25, Conference Rooms A & B.

Presentations with discussion and questions from 1:30-2:30 p.m.

**Friends of Dinosaur Ridge.** Friends of Dinosaur Ridge and cooperating institutions conduct guided tours for visitors to the Ridge, and many people visit on their own. In all, at least 38,000 people visited Dinosaur Ridge during 1994. Friends wishes to spread the word that they plan to accommodate all groups interested in a tour, but do need to schedule groups in advance to avoid conflict. Groups can call Friends at **303-697-DINO** to schedule a tour or for information about Dinosaur Ridge activities and location of lectures. In addition to tours of the Ridge, Friends can provide talks, lectures, and slide shows. Call Bob Kosiba at 303-399-7556 and he'll arrange a trained volunteer to speak to your group.

**Rocky Mountain Section-SEPM (Society for Sedimentary Geology).** Monthly meetings are held on the fourth Tuesday of the month from September through May, excluding December. All lectures held at the Denver Press Club, downtown Denver, 1330 Glenarm Pl., 2nd floor, unless otherwise noted. Cash bar at 11:30 a.m., lunch at 12:00, speaker at 12:30 p.m. For reservations, call 303-236-1540 before noon of the Friday prior to the luncheon. For further information, call Jeff May at 303-794-5414. Lunch reservation **not** required to attend lecture.

Next meeting to be held on November 28.

Colorado Scientific Society  
P.O. Box 150495  
Lakewood, CO 80215-0495

## Colorado Scientific Society

	<b>OFFICERS</b>		<b>COUNCILORS</b>
...			
President:	Susan M. Landon, Consultant, 436-1930	1993-95:	Marith C. Reheis, USGS, 236-1270
President-Elect:	Richard F. Madole, USGS, 273-8607	1993-95:	Karl S. Kellogg, USGS, 236-1305
Treasurer:	Paul L. Williams, USGS, 236-1256	1994-96:	Kathleen M. Haller, USGS, 273-8616
Secretary:	James A. Cappa, CGS, 866-2611	1994-96:	Frank J. Alder (retired)
Past President:	Jack Reed, USGS, 236-1276	1995-97:	Mark R. Hudson, USGS, 236-7446
		1995-97:	Susan Bartsch-Winkler, USGS, 236-8289

## COMMITTEE CHAIRPERSONS

...	Arrangements:	William E. Brooks, USGS, 236-5627
....	Best Paper Award:	Stephen A. Sonnenberg, Consultant, 238-8708
.	Field Trips:	Robert G. Reynolds, Consultant, 762-9379
.	Fund Raising:	David E. Eby, Consultant, 738-9697
.	History:	Marjorie E. Mac Lachlan, USGS-retired, 986-7192
.	Membership:	Mary-Margaret Coates, 422-8349
.	Memorial Funds:	Michael M. Machette, USGS, 273-8612
..	Memorial Funds Treasurer:	Vera H. Sable, USGS-retired, 526-9250
..	Newsletter Editor:	Brad Van Gosen, USGS, 236-1566
.	Outreach (signs):	Peter J. Modreski, USGS, 236-5639
..	Program:	Richard B. Wanty, USGS, 236-1819
....	Publicity:	Lisa Ramirez Bader, USGS, 236-5760
...	Science Fair:	Eric A. Erslev, CSU, 491-6375