

City of Rocks

Official Map and Guide



Geologic Resources Inventory Workshop Summary City of Rocks National Reserve, Idaho June 16-17, 1999

**National Park Service
Geologic Resources Division
and
Natural Resources Information Division**

Version: Draft of August 13, 1999

EXECUTIVE SUMMARY

An inventory workshop was held at City of Rocks National Reserve on June 16-17, 1999 to view and discuss the park's geologic resources, to address the status of geologic mapping for compiling both paper and digital maps, and to assess resource management issues and needs. Cooperators from the NPS Geologic Resources Division (GRD), Natural Resources Information Division (NRID), Columbia Cascades Support Office (CCSO), City of Rocks NR (interpretation, resource management and various others), US Geological Survey (USGS), Idaho State University, and various other local cooperators were present for the two-day workshop. ([see Appendix A, City of Rocks NR Geological Resources Inventory Workshop Participants, June 16-17, 1999](#))

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Additional information supplied by Dave Miller is entitled "***Geology of City of Rocks National Reserve, Cassia County, Idaho: Geology, landforms, and geologic stability***" by David M. Miller, Marsha Davis, David R. Bedford, Richard L. Armstrong, and Melanie Moreno; U.S. Geological Survey Report [or administrative report to the NPS] A cooperative study by the U.S. Geological Survey, National Park Service, and Idaho Department of Parks and Recreation and can be found online at:
http://www2.nature.nps.gov/grd/geology/gri/id/ciro/ciro_usgs.doc

Day one involved a field trip led by USGS Geologist Dave Miller, who has done extensive geologic mapping and research in the City of Rocks NR area.

An on-line slide show of the highlights of the field trip can be found at
http://www.nature.nps.gov/grd/geology/gri/id/ciro/field_trip_ciro

Day two involved a scoping session to present overviews of the NPS Inventory and Monitoring (I&M) program, the Geologic Resources Division, and the ongoing Geologic Resources Inventory (GRI). Round table discussions involving geologic issues for City of Rocks NR included interpretation, other resources issues and needs, the status of cooperative geologic mapping efforts, sources of available natural resource data, geologic hazards and other management issues, unique geologic features, potential future research topics, and action items generated from this meeting. Brief summaries of each follows.

OVERVIEW OF GEOLOGIC RESOURCES INVENTORY

After introductions by the participants, Joe Gregson (NPS-NRID) presented an overview of the NPS I&M Program, the status of the natural resource inventories, and the geological resources inventory (***see Appendix B, Overview of Geologic Resources Inventory***).

He also presented a demonstration of some of the main features of the **digital geologic map** for the Black Canyon of the Gunnison NM and Curecanti NRA areas in Colorado. This has become the prototype for the NPS digital geologic map model as it ideally reproduces all aspects of a paper map (i.e. it incorporates the map notes, cross sections, legend etc.) with the added benefit of being a GIS component. It is displayed in ESRI ArcView shape files and features a built-in help file system to identify the map units. It can also display scanned JPG or GIF images of the geologic cross sections supplied with the map. The cross section lines (ex. A-A') are subsequently digitized as a shape file and are hyperlinked to the scanned images.

For a recap on this process, go to:

http://www.nature.nps.gov/grd/geology/gri/blca_cure/ ***and view the various files in the directory.***

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The geologists at the workshop familiar with GIS methods were quite impressed with this method of displaying geologic maps digitally; Gregson is to be commended for his accomplishments.

Bruce Heise (NPS-GRD) followed with an introduction to the Geologic Resources Division. See the GRD website for more information at: <http://www2.nature.nps.gov/grd/>

INTERPRETATION

The GRI aims to help promote geologic resource interpretation within the parks and GRD has staff and technology to assist in preparation of useful materials including developing site bulletins and resource management proposal (RMP) statements appropriate to promoting geology.

Melanie Moreno (USGS-Menlo Park) has visited CIRO and plans to have some products delivered sometime this summer for brochures for geology trails and website material. She should be consulted for a progress report on this work. Marsha Davis should also be considered as an excellent source for producing brochures on the geology as she has done extensive work here too. Ted Scherff reiterated the importance of producing a one-page geology bulletin as an important interpretive need for the immediate future.

GRD is also working on creating a geology "field notes" page at <http://www2.nature.nps.gov/grd/parks/ciro/index.htm> for the near future.

Paul Link's book "*Rocks, Rails and Trails*" has a short segment featuring CIRO and is available at the visitor center. However, a more detailed brochure with roadlogs and park wayside exhibits, and perhaps curriculum oriented teaching guides featuring the geology are a welcomed product. It was mentioned that perhaps Carolyn Firth would like to become involved in developing such material and should be consulted as a potential future cooperator.

The new visitor center would be an excellent place for geologic displays, perhaps featuring the Almo Granite pluton and a 3-D raised relief map showing features and locations. Kiosks where people can interact with the GIS themes may also be useful.

A popular interpretive theme for CIRO should attempt to incorporate "that this was Yellowstone 10 million years ago" approach to boost interest in the geologic story.

A notable place for geologic interpretation within CIRO is at Bath Rock because it has good examples of rockfall, pediments, pinnacles and inclusions in granite that tell stories of geologic features and processes. The Twin Sisters are also a good place because of the significant difference in the age of the sisters and the relevance to the cultural implications of the California Trail and why this area was chosen over the Snake River plain and Salt Lake area.

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OTHER PARK SPECIFIC ISSUES

Of note regarding the CIRO bibliographic data was that their inventory and ProCite database has not yet been assembled, and that Marilyn Osterman (NPS-Columbia Cascades Support Office) should be consulted to have this done.

Ted Scherff mentioned that CIRO needs more specialized expertise and software for GIS. He mentioned that unified funding calls were not helping CIRO to date and that he would like to see at least one really proficient GIS person at the park, and an additional 2-3 "amateur" users for GIS to facilitate park GIS needs. Hardware, software and metadata training would be useful at the park level at this point in time.

A proposal writing class is offered by the Columbia Cascades Support Office (CCSO) in Seattle, and would be a good starting point for helping develop resource needs proposals (like GIS); Marsha Davis offered assistance to Ted Scherff along this front. GRD also offers technical assistance in some areas that may benefit CIRO, and should also be considered as a source of potential help.

Recreational rock use and overall storm impact has created a few management concerns. Specifically, rock climbing has recently begun to raise questions as to how it may be degrading the resources. CIRO Superintendent Ned Jackson has recently decided not to allow the use of power drills to assist rock climbers within the Reserve. Of note were damages to pinnacles along easily accessible trails. Also noted were impacts from vandals who have spray painted in various places. Also of concern is the effect of storms and raindrop spatter on a thin soil cover, as it is believed that salts and clays are intensely weathering much of the rock in specific places due to wet/dry variations. Marsha Davis has an excellent photo inventory to serve as a baseline for monitoring such resource degradation.

Stan Lloyd mentioned that it is common practice to take groups to the abandoned mica quarries (*the youngest pegmatites Tim Connors has ever seen!*) owned by his family. It was mentioned as a concern that this is a significant resource and that it should be conserved and protected, as it is likely that visitors are slowly exhausting this finite resource and that it may want to be enjoyed for future generations. Perhaps CIRO staff and Stan may want to develop a policy that allows visitor use and enjoyment while also preserving this unique mineral resource.

Woodcutting was mentioned as a common practice in and around the Reserve, and a fire management plan should be developed for CIRO. The cutting practice can become a major geologic issue as it can lead to increased erosion and run-off problems.

Also, erosion of thin granitic soils is of concern, particularly where erosion is enhanced by drainage diversions in a few places along roads and trails.

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WATER RESOURCES

Water quality is a significant issue at CIRO. It was noted by Stan Lloyd that water quality degrades significantly from Circle Creek to the visitor center where it meets minimum drinking water standards (he uses conductivity as a measure), likely because of the impacts of livestock and grazing on surface pollution. Perhaps a more in-depth study should be conducted to assess the overall water resources at CIRO.

This is a significant issue because of the construction (2002) of a new visitor center, headquarters and campground that will be located in these "lesser" quality areas. It is proposed that 100 full-service, and 25 primitive sites will be located here. Ted thought that one or two wells would be emplaced for recreational potable water by the end of 1999.

STATUS OF GEOLOGIC MAPPING EFFORTS FOR CITY OF ROCKS NR

Consult **Appendix C** (*City of Rocks NR Index of Quadrangle Maps 1:250,000 scale and larger*) for a quick reference of the area.

Within CIRO, the area is currently contained on two 1:24,000 quadrangles:

- **Cache Peak** and
- **Almo**

However, the surrounding quadrangles are also of use for park management goals. These include **Elba, Jim Sage Canyon, Basin, and Lyman Pass**.

Dave Miller (USGS-Western Region in Menlo Park, CA) and Marsha Davis (NPS-CCSO in Seattle, WA) have done extensive geologic mapping in the City of Rocks area.

Both have compiled various "themes" into a geographic information system (GIS) for CIRO.

NEED MORE SPECIFICS FROM DAVE ON HIS MAPS AND SCALES

OTHER SOURCES OF NATURAL RESOURCES DATA FOR CITY OF ROCKS

- NRID has compiled a geologic bibliography for numerous NPS areas, including City of Rocks. Visit the website at: <http://165.83.36.151/biblios/geobib.nsf>; user id is "geobib read", password is "anybody".
- Ted Scherff mentioned that a Natural Heritage database exists and should be tied into the Natural Resources databases including geology. It is likely available from Idaho state agencies, who should be consulted for any other databases that may be maintained at the state park level for CIRO
- Aerial photography from USFS that should be shared with Mike Story by Ted Scherff

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- Dave Miller and Marsha Davis have digitized a soils map from an SCS report; though it only covers 80% of CIRO it is probably quite useful. Pete Biggam needs to determine if it is useful or needs updated. Marsha and Dave extended the SCS data through the whole Reserve. It is an ArcView database.
- A study on the effects of climbing on the rocks at CIRO was done by a geologist and showed minimal impacts to the Twin Sisters. It apparently is available at CIRO and CCSO, and should be obtained by GRD for reference. Dave Miller says a recent article on this subject appeared in Science; it and follow-up letters are available from Dave Miller.
- Dave Miller has DOQs and DEMs that should be obtained by NRID and CIRO; also Marsha Davis has her photographic inventory available. Dave replied and says DOQs, DEMs and all other data sets will be delivered to CIRO with the completion of their study this summer; Sooner if wanted.

DISTURBED LANDS

Randy Farley was listed as the contact regarding Disturbed Lands (DL) for CIRO; Dave Steensen is the GRD DL coordinator. CIRO and GRD should consult on DL issues for CIRO. Disturbed Lands area subject to change as land swaps and other issues continue to develop at CIRO.

It was also noted that Ned Jackson (CIRO Superintendent) and Stan Lloyd should be consulted for supplying a list of identified mine sites within the Reserve, as they have intimate knowledge of the area. This data should attempt to be captured into a database and maintained by GRD.

The following were classified as disturbed lands:

- Recently acquired mica mines pose new questions regarding their status as potential Abandoned Mineral Lands (AML)
- Mining claims
- Jeep trails inventoried under "trail maintenance"; main focus of CIROs classification of Disturbed Lands.
- Deeply incised gulleys and diverted culverts related to upland use practices, run-off from roads and since closed trails and poorly engineered roads
- Agricultural and grazing impacts
- Water resources from springs and seeps have a high potential for disturbance

GEOLOGIC HAZARDS AND OTHER RESOURCE ISSUES

Dave Miller has derived numerous GIS layers that have management implications and are available as ArcInfo coverages. These layers assume natural conditions and don't take roads and other cultural features into account.

Among these "layers" are the following:

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- **Slopes:** geology, slope, soils and inferred precipitation from elevation (more precipitation at higher elevation)
- **Rockfall & topple:** shows susceptibilities as high, moderate, low
- **Debris flows:** gravity driven muddy slurries of rock/sediment depending on rock type and slope, and precipitation (more at higher elevations)
- **Water erosion** (gullyng): slope, precipitation and material (surficial more than bedrock) dependent. Archean schists are highly susceptible to gullyng though.
- **Enhanced earthquake shaking**
- **Deep seated slides and creep**
- **Soil deformation:** spring-rich areas in aspen grove are highly susceptible; moderate areas are probably due to seasonal implications from precipitation;
- **Fluvial deposition:** water laid sediments laid down by perennial creeks; comes from geologic maps
- **alluvial deposition:** intermittent deposition of sediments out of hills across alluvial fans and pediments where it's slope, water and material related.
- **Colluvial deposition:** tumbling at foots of cliffs and steep slopes by water and gravity falling from cliffs (around Twin Sisters)
- **Shrink-swell** (modeled from SCS data): expansive clays; has implications for building and road stability
- **Wind Erosion** (modeled from SCS data)
- **Map of pinnacles and landforms;** color-coded by age of granite that is substrate for various pinnacles
- **Slope map from 30 meters**

UNIQUE GEOLOGIC FEATURES

The City of Rocks area has some unique geologic features; a few are listed below:

- Cavernous weathering
- Pinnacles
- **Marsha's keywords from her MS PowerPoint presentation (need to get)**
- Prospects and mines
- Arches and windows (which are rare in granite terrain's)
- Fins, flutes, alcoves, columns
- Inscriptions on rocks (cultural feature)

POTENTIAL RESEARCH TOPICS FOR CITY OF ROCKS NR

A general note from Dave Miller: There is overlap and disconnect between Paul's list and the one we generated the second day, when he was unable to attend. I think this should be smoothed out, or no one will be able to figure out what we came up with. This is important to communicate as best we can!

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Idaho State Professor Paul Link supplied numerous research topics that are enumerated below and could be coordinated by Scott Hughes and himself:

- More actively market the Rocks, Rails and Trails book at CIRO. Let rangers and temporary folks know that the book contains most of the often-asked questions about CIRO history and geology.
- Note that the Rocks Rails and Trails book will be part of the Idaho Digital Atlas project, with a website maintained at the Idaho Museum of Natural History. Hopefully much CIRO geologic information could be also housed there, or at least a link established.

Dave's response: Yes, let's make sure that all info is linked, maybe by the web pages that Tim, Jim, and Melanie are making? Can you send us more info on the website maintained at the Idaho Museum of Natural History?

- Investigate the feasibility of a project, coordinated by ISU Geophysicist Joe Kruger, to use Ground Penetrating Radar to test the hypothesis that the CIRO dome forms are formed under an alluvial and soil cover and then exhumed. Study area could be east of Bath Rock. Project could be a MS thesis or a class project.

Dave's response: I would suggest a study north of Twin Sisters, in the upper part of that basin. Such a study could seek to understand the basin floor, the western head of the basin (scarp), and then maybe the changes as one approaches the "spine" on the north (near Bath Rock). East of Bath is mostly bare rock. The Circle Cr. valley floor is very wet, and is private land and may not be accessible.

- Investigate a geochemical project comparing the honeycomb rocks with the case hardened ones. Likely trace geochemical variables control the erodability of the rocks.

Dave's response: We talked a bit about this idea on the second day. Our thoughts were to combine geochemistry, isotope studies, and thin section/x-ray work on mineralogy of crusts. There are several types of case hardening, and it's probably necessary to tackle them all.

- Begin, and continue as funding is available, ongoing student geologic research in the CIRO area. One idea is further work on the Neoproterozoic sandstones on the top of Mount Harrison.

Dave's response: Yeah, there's lots of good work to be done in the area, but let's make sure these studies relate to CIRO. Mt. Harrison is a world away in many respects. Tracing the frontal fault northward would be interesting and have implications for seismic hazards. Shallow geophysics of the apron in front of the fault, likewise. Metamorphic conditions are being studied by Tom Hoisch (NAU) at this time; as that work is finished it might point to further studies needed.

- Paul would be glad to work with CIRO personnel and area teachers to help them prepare educational material and field trip material for the area. This would all be

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linked to the Idaho Virtual Campus and Idaho Digital Atlas

Dave's response: There was also talk about this. I think Ted is a good coordinator for this function. We talked about the possibility that Carolyn might help.

Other suggested topics include the following:

- A study of the historic land use practices and their effects on the natural environment
- Water quality survey for Stan addressing the downgradient changes occurring from Circle Creek to Emigrant and Twin Sister Basins
- Determine ways to effectively remove vandal graffiti from rock
- Study scarp retreat and subsequent pinnacle development (is it subaerial)
- Study of Pan-hole formation
- Study subsurface pinnacle development using Ground Penetrating Radar (GPR)
- Study of overall landscape development process
- Study glacial flow around pinnacles on the south side of Mount Independence
- Investigate pack rat middens and climate change; maybe consult with Jim Mead at NAU who works with NPS on pack rat middens
- Use isotopes to study geochemistry and mineralogy on case hardening
- Research natural area (RNA) where recovery from fire has been slow, look at weathering rates here as compared to unburned areas
- Use recently acquired lands as monitoring point as new land use practices are implemented (i.e. Heavy grazing to no grazing)
- Camp Rock appears to be exfoliating and should be studied for potential impacts from vehicle exhausts due to the proximity of the road
- Study overall weathering of granite-type rocks using thin sections and geochemical analysis. Consult with USFS personnel working on Idaho Batholith for rock characterization

ACTION ITEMS

Many follow-up items were discussed during the course of the scoping session and are reiterated by category for quick reference.

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Interpretation

- Consult with Melanie Moreno for the status of development of brochures and websites for CIRO
- Consult with Carolyn Firth for her interest in developing site specific geologic material

Other Park Specific Issues

- try to develop in-house expertise for a GIS program at CIRO with improved hardware, software and overall training
- CIRO staff consult with CCSO on successful proposal writing class to develop funding for resource management needs (such as funding GIS)
- Consult with organizations who must restore vandalized (spray painted) granite statues and such to determine the best ways to remediate without further impacting the geologic features.

Specific Resources

- Develop an in-house plan to inventory, monitor and protect significant resources from threats; assign staff to oversee
- Vince Santucci should be contacted about any CIRO paleo collections for his database

Geologic Mapping

- Maintain USGS-NPS cooperation to reap all possible products from existing work to benefit the NPS GRI
- Ensure that geology is part of the inventory of any newly acquired lands
- Obtain Dave Miller's digital geologic ArcInfo coverages

Natural Resource Data Sources

- Attempt to obtain permission to reprint or web-post various publications on CIRO from various publishers
- CIRO and NRID need to contact Marilyn Osterman about the status of completing their ProCite bibliographic inventory for CIRO; better lines of communication about the status and location of such inventories need to be provided by NRID to parks.
- Ted Scherff should contact NRIDs Mike Story (Mike_Story@nps.gov; Vegetation Mapping) to let him know what the USFS has supplied to CIRO for aerial photography.

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- Pete Biggam (NRID-Soils) needs to review Miller's digitized soils map for content and accuracy to determine its usefulness in a GIS.
- Locate study on rock climbing within CIRO by geologist and supply to GRD for reference and general records.
- Dave Miller suggested consulting data at the Cache County Museum for any relevance to resources and features at CIRO, especially historic photography to compare with the current condition of pinnacles and rangeland.
- Develop a database of AML sites at CIRO as supplied by Ned Jackson and Stan Lloyd; consider using the Dave Miller and Marsha Davis inventory of mines and prospects in ArcView as a starting point.

Miscellaneous

- Obtain Marsha's list of keyword unique features from her PowerPoint presentation, as well as the presentation itself
- Dave needs to GPS Circle Creek overlook as it's a permanent feature but shows up on very few maps
- Visit the USGS document on CIRO at:
http://www2.nature.nps.gov/grd/geology/gri/id/ciro/ciro_usgs.doc

APPENDIX A
City of Rocks NR Geological Resources Inventory Workshop Participants
June 16-17, 1999

NAME	AFFILIATION	PHONE	E-MAIL	Field Trip	Scoping Session
Bruce Heise	NPS, Geologic Resources Division	(303) 969-2017	Bruce_Heise@NPS.gov	x	x
Joe Gregson	NPS, Natural Resources Information Division	(970) 225-3559	Joe_Gregson@NPS.gov	x	x
Tim Connors	NPS, Geologic Resources Division	(303) 969-2093	Tim_Connors@NPS.gov	x	x
Marsha Davis	NPS, Columbia Cascades Support Office	(206) 220-4262	Marsha_Davis@NPS.gov	X	x
Dave Miller	USGS	(650) 329-4923	Dmiller@usgs.gov	X	X
Paul Link	Idaho State University	(208) 236-3365	Linkpaul@isu.edu	X	
Stan Lloyd	CIRO cooperater	(208) 638-5542		X	X
Ted Scherff	CIRO/IDPR	(208) 824-5519	Ted_Scherff@NPS.gov	X	X
Carolyn Firth	College of Southern Idaho	(208) 438-8215		X	
John Russell	CIRO/IDPR	(208) 824-5519	Ciro_interpretation@NPS.gov	X	X
Greg Sprouse	CIRO, SCA volunteer		Gtsprouse@yahoo.com	X	
Andy Millott	CIRO, Americorps		Aj.millott@eudoramail.com	X	
David Landrum	Lake Walcott State Park	(208) 436-1258		X	
Chris Gee	CIRO	(208) 824-5519		X	
Whitney Warner	CIRO	(208) 824-5519		X	

APPENDIX B

Overview of Geologic Resources Inventory

The NPS Geologic Inventory is a collaborative effort of the NPS Geologic Resources Division (GRD) and Inventory and Monitoring Program (I&M) with assistance from the U.S. Geological Survey (USGS), American Association of State Geologists (AASG), and numerous individual volunteers and cooperators at NPS units, colleges, and universities.

From the perspective of the servicewide I&M Program, the primary focus (Level 1) of the geological inventory is

1. to assemble a bibliography of associated geological resources for NPS units with significant natural resources,
2. to compile and evaluate a list of existing geologic maps for each unit,
3. to develop digital geologic map products, and
4. to complete a geological report that synthesizes much of the existing geologic knowledge about each park. The emphasis of the inventory is not to routinely initiate new geologic mapping projects, but to aggregate existing information and identify where serious geologic data needs and issues exist in the National Park System.

The NPS Geologic Resources Division is an active participant in the I&M Program and has provided guidance and funding in the development of inventory goals and activities. GRD administers the Abandoned Mine Lands (AML) and Geologists In Parks (GIP) programs which contribute to the inventory. NPS paleontologists, geologists, and other natural resource professionals also contribute to inventory planning and data. A major goal of the collaborative effort is to provide a broad baseline of geologic data and scientific support to assist park managers with earth resource issues that may arise.

For each NPS unit, a cooperative group of geologists and NPS personnel (the Park Team) will be assembled to advise and assist with the inventory. Park Teams will meet at the each NPS unit to discuss and scope the geologic resources and inventory, which is the subject of this report. If needed, a second meeting will be held at a central office to evaluate available geologic maps for digital production. After the two meetings, digital geologic map products and a geologic report will be produced. The report will summarize the geologic inventory activities and basic geology topics for each park unit. Due to the variety of geologic settings throughout the NPS, each report will vary in subject matter covered, and section topics will be adapted as needed to describe the geologic resources of each unit. Whenever possible the scientific sections of the report will be written by knowledgeable cooperators and peer reviewed for accuracy and validity.

APPENDIX C

City of Rocks NR

Index of Quadrangle Maps (1:250,000 scale and larger)

