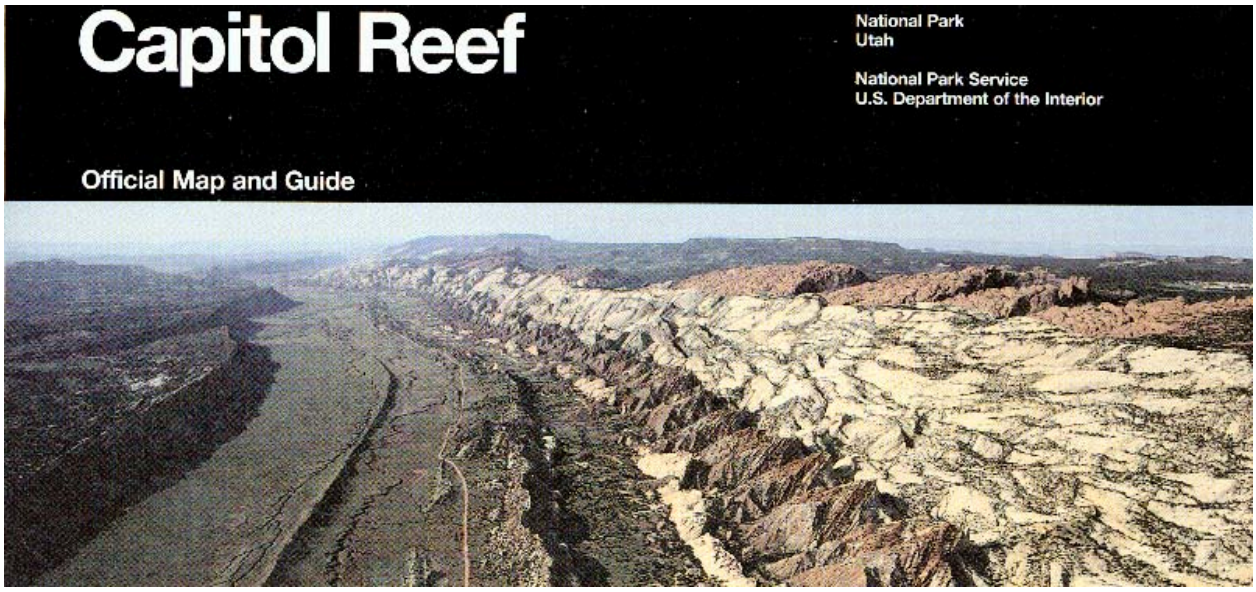


Geologic Resources Inventory Workshop Summary
Capitol Reef National Park
September 27-28, 1999

National Park Service
Geologic Resources Division
and
Natural Resources Information Division

Version: Draft of November 5, 1999

EXECUTIVE SUMMARY

An inventory workshop was held at Capitol Reef NP on September 27-28, 1999 to view and discuss the park's geologic resources, to address the status of geologic mapping by both the Utah Geological Survey (UGS) and the United States Geological Survey (USGS) 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), Capitol Reef NP, UGS, USGS, and Brigham Young University (BYU) were present for the two-day workshop. (***See Appendix A, Capitol Reef NP Geological Resources Inventory Workshop Participants, September 27-28, 1999***)

Day one involved a field trip throughout the northern extent of Capitol Reef NP co-led by USGS geologists Pete Peterson and George Billingsley.

Highlights of the field trip can be found at http://www.nature.nps.gov/grd/geology/gri/ut/care/field_trip_care

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) for Colorado and Utah. Round table discussions involving geologic issues for Capitol Reef NP included interpretation, soils mapping, paleontologic resources, the UGA Millennium 2000 guidebook featuring the geology of Utah's National and State parks, the status of cooperative geologic mapping efforts, sources of available data, geologic hazards, potential future research topics, and action items generated from this meeting. Brief summaries of each follow.

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 geologic 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 NP and Curecanti NRA 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.***

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

Joe also demonstrated the developing NPS data browser for adding various coverages into GIS projects "on-the-fly". With this functional data browser, numerous NPS themes can be added to an ArcView project with relative ease. Such themes might include geology, paleontology, hypsography (topographic contours), vegetation, soils, etc.

Bruce Heise (NPS-GRD) followed with an overview of the Geologic Resources Division and the Geologic Resources Inventory with the main goals summarized below:

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.

An 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.

INTERPRETATION

The GRI also 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. Jim Wood (GRD) and Melanie Moreno (USGS-Menlo Park, CA) have worked with several other NPS units in developing web-based geology interpretation themes, and should be considered as a source of assistance should the park desire. Allyson Mathis, formerly of CARE, has developed numerous geologic materials to aid in interpretation that are distributed in the CARE visitor center.

The UGS has their Geologic Extension Services available for help to the NPS for creating interpretive brochures and for seasonal employee training. The UGS also has programs for applied geology (hazards), economic geology, archeology and paleontology. Their contact person is Sandy Eldredge (nrugs.seldredg@state.ut.us)

Vicky Wood (BYU) attended the scoping meeting and is interested in developing a virtual geologic field trip through CARE for her graduate degree requirements.

A Chinle Ecosystem reconstruction project (similar to one already done for the Morrison Ecosystem) was talked about, and CARE would certainly be one of the better NPS areas for such a study. Only time will tell if this will come to fruition.

UGA GUIDEBOOK ON UTAH'S NATIONAL AND STATE PARK AREAS

Doug Sprinkel of the UGA announced that a guidebook treating the geology of Utah's national and state parks and monuments would be compiled for publication in September 2000. This compilation will be a snapshot into the geology of each park and

covers most facets of what the GRI is trying to develop for each park for a final report (i.e. cross sections, simplified geologic map, general discussions of rocks, structure, unique aspects of park geology, classic viewing localities). The only NPS unit in Utah that will ***not*** be treated will be Golden Spike National Historic Site (GOSP).

Funding for this publication is coming jointly from the UGA, NPS, BLM, USFS and Utah state parks; it is hoped that the publication will be sold for under $30.

Each author will be *encouraged* to get with NPS staff interpreters as a courtesy to develop a product that aims at a wide audience (the common visitor, the technical audience and the teaching community). Capitol Reef NP authors will be Tom Morris and Vicky Wood (both BYU) and Allyson Mathis (formerly of CARE).

Park authors are strongly encouraged to get with NPS staff to also make sure that any trail logs do follow maintained trails and do not take visitors into unauthorized areas, or places where resources are fragile and would be disturbed by increased visitation (i.e. areas with crytptogamic soils).

Also, a CD-ROM will be distributed with the publication featuring road and trail logs for specific parks as well as a photo glossary and gallery. The photo glossary will describe certain geologic features (i.e. *what is crossbedding?*). These will also be available as web-downloadable Adobe Acrobat PDF files. The UGA cannot copyright this material because it is funded with state money, so it can be distributed widely and freely, which will also benefit the purposes of the GRI. Additional reprints are not a problem because of the digital nature of the publication and the UGA board is committed to additional printings as needed. UGA normally prints 1000 copies of their publications because they become dated after about five years; that will probably not be an issue for this publication. Prices for the full-color guidebook are estimated to be approximately $25/copy, and sales are expected to be high (exact estimates for Capitol Reef NP were 125 copies/year). A website for the guidebook is at http://www.ugs.state.ut.us/uga.htm.

Field Trips will be held in September 2000. Currently, four field trips are scheduled:
1. **Moab area**: Arches NP, Canyonlands NP, Dead Horse Point State Park (SP)
2. **Wasatch Front**: Antelope Island SP and Wasatch Mountain SP
3. **St. George area**: Zion NP, Capitol Reef NP and, Snow Canyon and Quail Creek SPs
4. **Vernal area**: Dinosaur NM, Flaming Gorge NRA, and Red Fleet SP

Note: Trips 1 and 2 will run concurrently and Trips 3 and 4 will also run concurrently.

Many other benefits are anticipated from this publication and are enumerated below:
- This type of project could serve as a model for other states to follow to bolster tourism and book sales promoting their state and its geologic features.

- Sandy Eldredge (UGS) will be targeting teaching communities for involvement in the field trips; hopefully teachers will pass on what they have learned to their young audience.

- The language is intended to appeal to someone with a moderate background in geology and yet will be very informative to the educated geologist.

- The publication may be able to serve as a textbook to colleges teaching Geology of National Parks (in Utah).

- A welcomed by-product could be roadlogs between parks in Utah for those visiting multiple parks, perhaps with a regional synthesis summarizing how the overall picture of Utah geology has developed.

SOILS MAPPING STATUS

Note: Awaiting Pete's revisions as of 991105

Pete Biggam handed out an overview of the current status of soils maps for Capitol Reef as follows:

Soils have been mapped and digitized by the NRCS, and have been provided to CARE. This data has not been fully correlated by NRCS, and the soil attributes still need to be updated to current standards. The digital data was developed before NRCS implemented their current standards for soil survey digitizing.

Soils for CARE are contained within one soil survey area, and negotiations are currently underway to determine what all will be needed to correlate the survey area to NRCS standards, as well as provide an updated digital soils layer, soil attributes, soils manuscript, and metadata to NPS.

The I & M soils priority for CARE is 1.

PALEONTOLOGICAL AND OTHER NATURAL RESOURCES

Vince Santucci (NPS-GRD Paleontologist) presented an overview of paleontological resources for CARE and the NPS in general. GRD provides support on policy and GPRA goals related to paleontological resources in parks. Paleontology is not currently part of the first level of the I&M program, but this may change in the future. Vince also mentioned the need for a mandate for protecting paleontological resources within federal lands. Vince has participated in refresher training courses for NPS rangers at CARE to make them more aware of the importance of realizing and protecting paleontological resources. A first step is to make parks realize if they have significant paleontological resources, and second is to conduct baseline inventories.

Tom Clark (CARE-natural resources) is interested in having a Paleontological Survey conducted for CARE. Similar studies have been done at Zion, Yellowstone and Death

Valley. Vince Santucci (NPS-GRD Paleontologist) has offered to conduct such a survey for the park.

Similar surveys have shed valuable new information on previously unrecognized resources. These surveys involve a literature review/bibliography and recognition of type specimens, species lists, and maps (which are unpublished to protect locality information), and also make park specific recommendations for protecting and preserving the resources.

The Death Valley Survey will be available soon. The **Yellowstone** Survey is already available on-line at:
http://www.nature.nps.gov/grd/geology/paleo/yell_survey/index.htm

and is also available as a downloadable PDF at
http://www.nature.nps.gov/grd/geology/paleo/yell.pdf

If a paleontological survey yields additional significant findings, paleontological resource management plans should be produced for Capitol Reef involving some inventory and monitoring to identify human and natural threats to these resources. Perhaps someone on the park staff could be assigned to coordinate paleontological resource management and incorporate any findings or suggestions into the parks general management plan (GMP). It would be useful to train park staff (including interpreters and law enforcement) in resource protection, as the fossil trade "black market" has become quite lucrative for sellers and often results in illegal collecting from federal lands.

Collections taken from this area that now reside in outside repositories should be tracked down for inventory purposes. Fossils offer many interpretive themes and combine a geology/biology link and should be utilized as much as possible in interpretive programs.

Also mentioned as being significant paleontological resources for CARE are the following:

- Both invertebrate and vertebrate traces from the Moenkopi and Chinle formations
- Vertebrate tracks in Kayenta formation
- Dinosaur bones in Morrison Formation
- Petrified trees in Salt Wash Member of the Morrison Formation outside park boundary; some also near Terry mines
- Cretaceous suite of marine invertebrates in Tunnock Shale (griffia novaria, exogyra); oyster shell reef in Dakota Sandstone
- Pack-rat middens
- Ammonite zone in Moenkopi Formation
- Pentacrinus zones in Sinbad Member of Carmel Formation

Also mentioned in discussions were the current cases involving mineral and fossil poaching from CARE. The Tidwell Member of the Morrison Formation contains numerous "sunset" agate concretions that are targets of rockhounds. Gypsum crystals are also in high demand and a 1996 theft case is currently being prosecuted that originated in CARE. Phil Cloues (GRD Mineral Economist) may have more specifics on this case.

GEOLOGIC MAPPING

Current Status

The "*Geologic Map of Capitol Reef National Park and Vicinity, Emery, Garfield, Millard and Wayne Counties, Utah*" by George Billingsley, Peter Huntoon, and William Breed, (1987) in paper form is sold in the Capitol Reef NP visitor center for $8.00. The scale is ***1:62,500.***

This map has been digitized by the former CARE GIS person (Jennifer), and GRD has obtained these coverages in ArcView format from the NPS Intermountain Region (Michelle Gudorf), and is currently working on attributing per the NPS model. A faults layer is also part of this coverage. A digital geologic map product should be available by December 1999.

It was agreed that this map is adequate for the purposes of the GRI at this present time. If funding and staff were available, some improvements were suggested and are denoted below.

Suggested improvements to existing coverage

Since the existing CARE coverage is at ***1:62,500*** scale, it was suggested that enhanced ***1:24,000*** coverage may be desirable for certain resource issues (including roads, campgrounds, vegetation, soil, and wastewater where there is heavier use) as it relates to park concerns. Thus the following were suggested for mapping improvements at *24,000* scale:

- More detailed mapping of surficial units along the Fremont River
- Identification and placement of new map units not on existing ***62,500*** map
- Mapping of gravel terraces that tell an important geologic story about CARE
- Mountain top boulder deposits have an important role in groundwater recharge and geologic hazard identification
- Joint systems need to be incorporated onto the existing map and are important to the groundwater story
- Delineating range management and endangered species areas
- Waterpocket Fold
- Burr Trail (for hazard assessments); Wagon Box Mesa, The Post, and Bitter Creek Divide were all mentioned by name along this route
- Heavy use areas ("threshold zone / backcountry") such as the Fruita-Scenic Drive (**Twin Rocks, Fruita** and **Golden Throne *24,000*** quadrangles)

Additionally, several 7.5-minute quadrangles cover Capitol Reef NP. (***see Appendix C, Capitol Reef NP Index of Geologic Maps, 1:24,000 Scale)***. Tom Morris (BYU) expressed some interest in EDMAP funds to map some of these quadrangles with BYU students and professors (who could offer mentoring and guidance). Additional funding sources could come from GRD, CARE, and the Geological Society of America (GSA). UGS is also willing to assist in any way possible with any mapping efforts by offering field support and reconnaissance on these ***24,000*** sheets

UGS Perspective
Currently, the UGS is mapping in Utah at three different scales:

- ***1:24,000*** for high priority areas (i.e. National and State parks)
- ***1:100,000*** for the rest of the state
- ***1:500,000*** for a compiled state geologic map

The UGS plans to complete mapping for the entire state of Utah within 10-15 years at *1:100,000* scale. For ***1:100,000*** scale maps, their goal is to produce *both* paper and digital maps; for ***1:24,000*** scale maps, the only digital products will be from "special interest" areas (i.e. areas such as Zion and growing metropolitan St. George). Grant Willis mentioned that the UGS simply does not have enough manpower and resources to do more areas at this scale. He also reiterated that UGS mapping goals are coincident with those of the National Geologic Mapping Program.

The UGS ***100,000*** scale sheets that cover Capitol Reef are Loa, Salina, Hites Crossing, and Escalante. (***see Appendix D, UGS Index of Quadrangle Maps, 1:100,000 scale***) The **Loa** and **Salina** sheets are currently low priorities for the UGS while **Escalante** and ***portions*** of **Hites Crossing** are completed both in paper and digital format.

OTHER SOURCES OF NATURAL RESOURCES DATA

- The UGS has a significant quadrangle database that they have furnished to NRID for the entire state of Utah entitled "Digital Geologic Resources Atlas of Utah" by Doug Sprinkel (March 1999)

- NRID has compiled a geologic bibliography for numerous parks and monuments, including Capitol Reef NP. Visit the website at: http://165.83.36.151/biblios/geobib.nsf; **user id** is "*geobib read*", **password** is "*anybody*".

- Abandoned Mineral Land (AML) database by John Burghardt (GRD). Apparently there is a GIS layer for AML created by Jennifer. Also, several reports from GRD on the Oyler, Terry and Rainy Day mine closures exist in addition to inventories for several other sites within CARE (3 of 10 sites mitigated); there are 27 openings at 10 sites inventoried; all are uranium.

- USGS Professional Paper 363 "*Geology of Capitol Reef Area, Wayne and Garfield Counties, Utah*" by J. Fred Smith Jr., Lyman C. Huff, E. Neal Hinrichs, and Robert G. Luedke, 1963 in cooperation with the US Atomic Energy Commission.

- George Davis (Arizona University) recently published GSA Special Paper 342 entitled "*Structural Geology of the Colorado Plateau Region of Southern Utah with Special Emphasis on Deformation Bands*" available from GSA. It specifically thanks the CARE staff for their cooperation in this project.

- Allyson Mathis has maintained a database on CARE geologic features that was mentioned at the meeting, but needs still to be obtained by GRD

- Engelmanns GPS locations from Morrison Ecosystem study

- Previously mentioned digital geologic map from Billingsley et al 1987 map with fault layers

- UGS paper and digital *1:100,000* scale coverages of the Escalante and Hites Crossing sheets

- Soils data from NRCS

GEOLOGIC HAZARDS

The following were recognized as geologic hazards:

- Rockfalls
- Floods
- Debris flows
- Uranium/radon
- Expansive clays
- Old adits from AML sites
- Faults: closest active fault is on west side of plateau according to Grant; Allyson thinks there is an active fault somewhere next to Needles with a report on it (source unknown); Tom says 3.8 earthquake shook area around Spring 1998 up Fremont River
- Water quality issues for WRD

POTENTIAL RESEARCH TOPICS FOR CAPITOL REEF NP

A list of potential research topics includes studies of the following:

- Paleo current directions in Kayenta time (currently studied by Rice University?)
- Black boulder debris flows
- Track studies by Kirby & McAllister
- possible new tracksite in Moenkopi (from Jackie Huntoon)
- Study Playa deposits in Cottonwood Wash in Navajo Sandstone for flood events

- Joint systems/fracture study for entire park for water quality issues
- Study Selenite deposits and structure of gypsum sinkhole
- Terrace deposits (rework late Cenozoic history of park); hasn't been done well to this point in time
- Study origin of honeycomb weathering patterns
- Soft sediment deformation in Navajo and Entrada formations
- Conduct full Paleontological survey
- Study depositional environments of earthy Entrada facies, Curtis, Summerville, Morrison formations, etc.
- Chinle Ecosystem study (for Russ Dubiel at USGS)
- Dike/sill emplacement history, petrology, depth of source and emplacement and relate to uplift and erosion story of Colorado Plateau
- Study structure of Waterpocket fold at depth
- Tie soil chemistry to rare plants; overall soil characterization
- Tie CARE story to adjacent areas for interpreters to present to public
- Inventory commercially valuable minerals for collecting
- Study entrenched meanders along Fremont River, Halls Creek drainage, Sulfur Creek

DISTURBED LANDS

The following pertain to disturbed lands / abandoned mineral lands at CARE:

- There are AML summaries from GRD that are in GIS layer already; according to John Burghardt (GRD) 3 of 10 sites mitigated (Oyler, Terry, Rainy Day). There are 27 openings at the 10 sites
- ***Preliminary*** disturbed lands map GIS layer exists according to Tom Clark for roads they want closed, cattle ponds, dams, tanks etc.
- Some small borrow pits may be along the Burr Trail; also Notom Road has some low-grade coal near Highway 24 East in Carmel
- Oak Creek cattle grazing has hammered the area there, some disturbance along Pleasant Creek

UNIQUE GEOLOGIC FEATURES

- **Type sections:** Torrey Member of Moenkopi, Capitol Reef Bed in Chinle (member unknown, likely Petrified Forest Member). Moody Canyons (near Escalante, likely outside park) of Moenkopi. San Raphael area has a few (San Raphael Group, Bluegate member in Mancos shale, Tunnock in Mancos, Muley Canyon, Tarantula Mesa sandstone)
- Sills/ Dikes in north district
- Selenite crystals (Glass Mountain area)
- Cathedrals in Cathedral Valley
- Waterpocket Fold
- Black boulder deposits
- Geomorphology in general, specifically the slot canyons (Halls Creek narrows)

- Gypsum sinkholes
- Strike valley
- Soft sediment deformation
- Capitol Dome
- Sapping features – alcoves in halls creek area (cutoff meanders)
- Red slide down by Halls Creek
- Hoodoos, demoiselles

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

Interpretation
- If desired consult with GRD's Jim Wood (jim_f._wood@nps.gov), UGS Sandy Eldredge(nrugs.seldredge@state.ut.us) or Melanie Moreno at the USGS-Menlo Park, CA (mmoreno@usgs.gov) for additional assistance with various interpretation themes
- Push for Chinle Ecosystem study as joint NPS-USGS project

UGA Guidebook
- Attempt to plant the seeds of this concept to other states for similar publications involving local area geology. Such publications are especially useful for the GRI
- Guidebook authors consult with CARE staff on content of publication and sensitive data issues

Natural Resources
- Consult with Vince Santucci on the scheduling of a full paleontological survey for CARE
- Al Hendricks (CARE superintendent) is looking for consultation assistance for failed leach fields from WRD. It was suggested that Larry Martin (WRD) and Phil Ayres (Intermountain Region) be consulted.

Geologic Mapping
- Attribute the existing digitized maps per NPS model; distribute to CARE in late 1999
- Delineate areas for 24,000 scale mapping; work with BYU for EDMAP funds to complete
- Obtain existing UGS coverages for Escalante and Hites Crossing *100,000* sheets

Natural Resource Data Sources
- Incorporate AML and Disturbed Lands data into digital product for CARE GIS layers

Miscellaneous
- Review proposed research topics for future studies within Capitol Reef NP

- Consult with WRD and Intermountain Region experts on failed leach fields

APPENDIX A
Capitol Reef NP Geological Resources Inventory Workshop Participants
September 27-28, 1999

NAME	*AFFILIATION*	*PHONE*	*E-MAIL*	Field Trip	Scoping Session
Tom Morris	Brigham Young University	(801) 378-3761	Tom_Morris@byu.edu	X	X
Vicky Wood	Brigham Young University	(801) 798-3882	Vaw3@byuemail.edu	X	X
Bruce Heise	NPS, Geologic Resources Division	(303) 969-2017	Bruce_Heise@nps.gov	X	X
Tim Connors	NPS, Geologic Resources Division	(303) 969-2093	Tim_Connors@nps.gov	X	X
Vince Santucci	NPS, Geologic Resources Division Fossil Butte NM, Wyoming	(307) 877-4455	Vincent_Santucci@nps.gov	X	X
Joe Gregson	NPS, Natural Resources Information Division	(970) 225-3559	Joe_Gregson@nps.gov	X	X
Pete Biggam	NPS, Natural Resources Information Division	(303) 987-6948	Pete_Biggam@nps.gov	X	X
Allyson Mathys	NPS- formerly CARE; presently Grand Canyon NP	(505) 278-2201 ext. 231	Allyson_Mathis@nps.gov	X	X
Dave Worthington	NPS-CARE, Biologist	(435) 425-3791 ext. 145	Dave_Worthington@nps.gov	X	X
Tom Clark	NPS-CARE, Resources	(435) 425-3791 ext. 144	Tom_O_Clark@nps.gov	X	X
Al Hendricks	NPS-CARE, Superintendent	(435) 425-3791 ext. 100	Al_Hendricks@nps.gov		X
Pete Peterson	USGS-Denver, CO	(303) 236-1546	Fpeterson@usgs.gov	X	X
George Billingsley	USGS-Flagstaff, AZ	(520) 556-7198	Gbillingsley@usgs.gov	X	X
Doug Sprinkel	Utah Geological Association	(801) 782-3398	Sprinkel@vii.com	X	X
Grant Willis	Utah Geological Survey	(801) 537-3355	Nrugs.gwillis@state.ut.us	X	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,

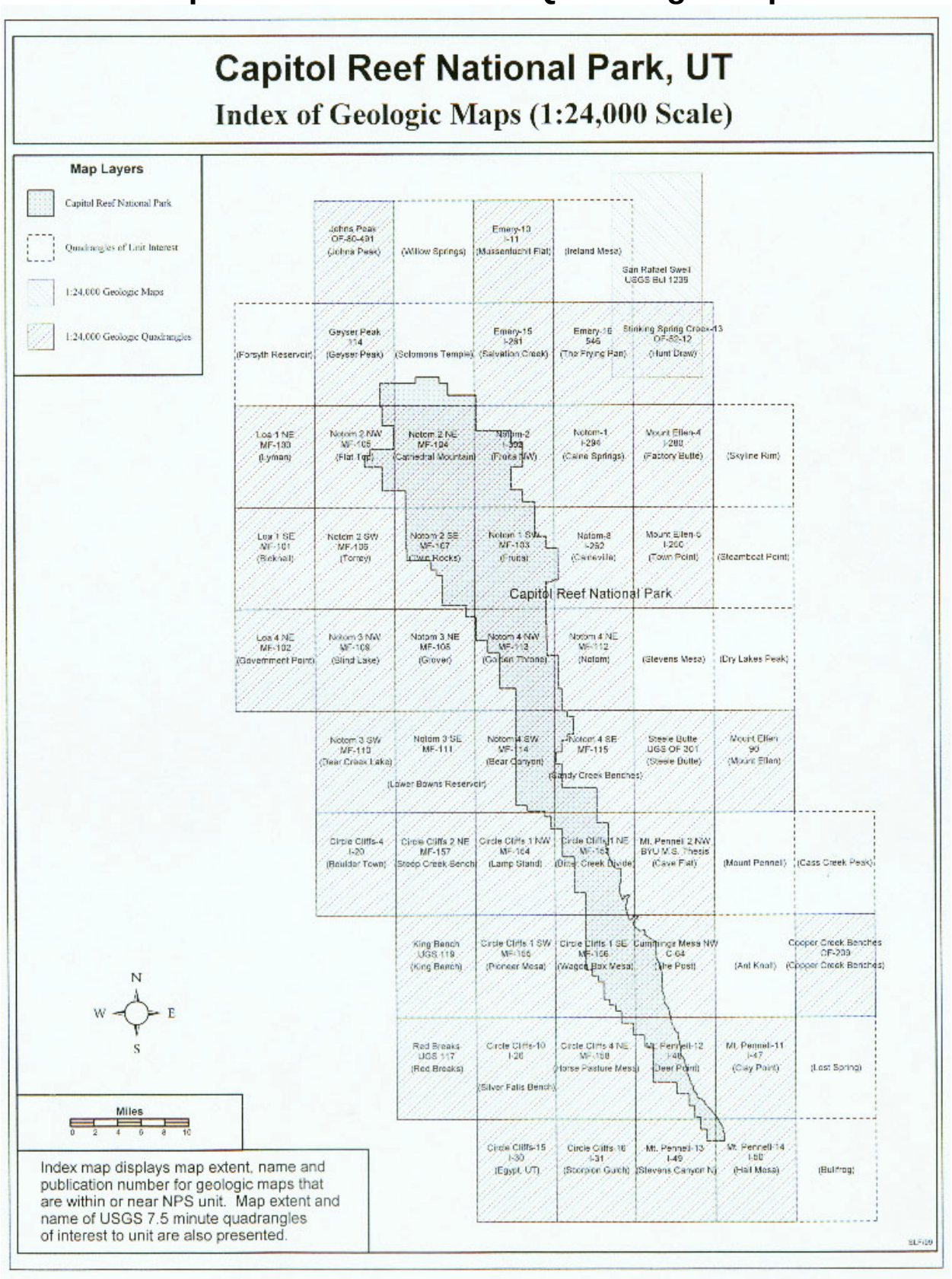
3. to develop digital geologic map products, and

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
Capitol Reef NP Index of Quadrangle Maps



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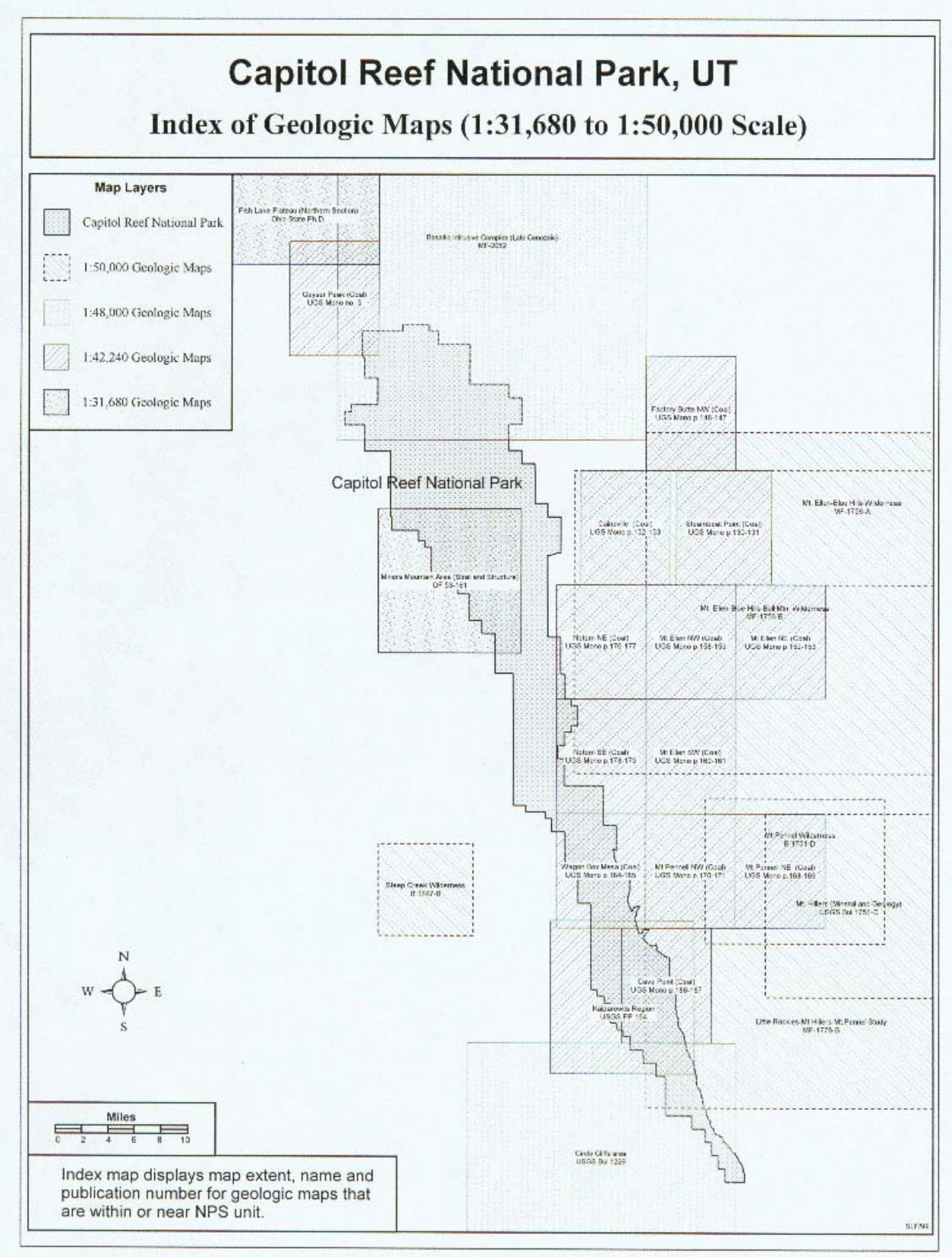

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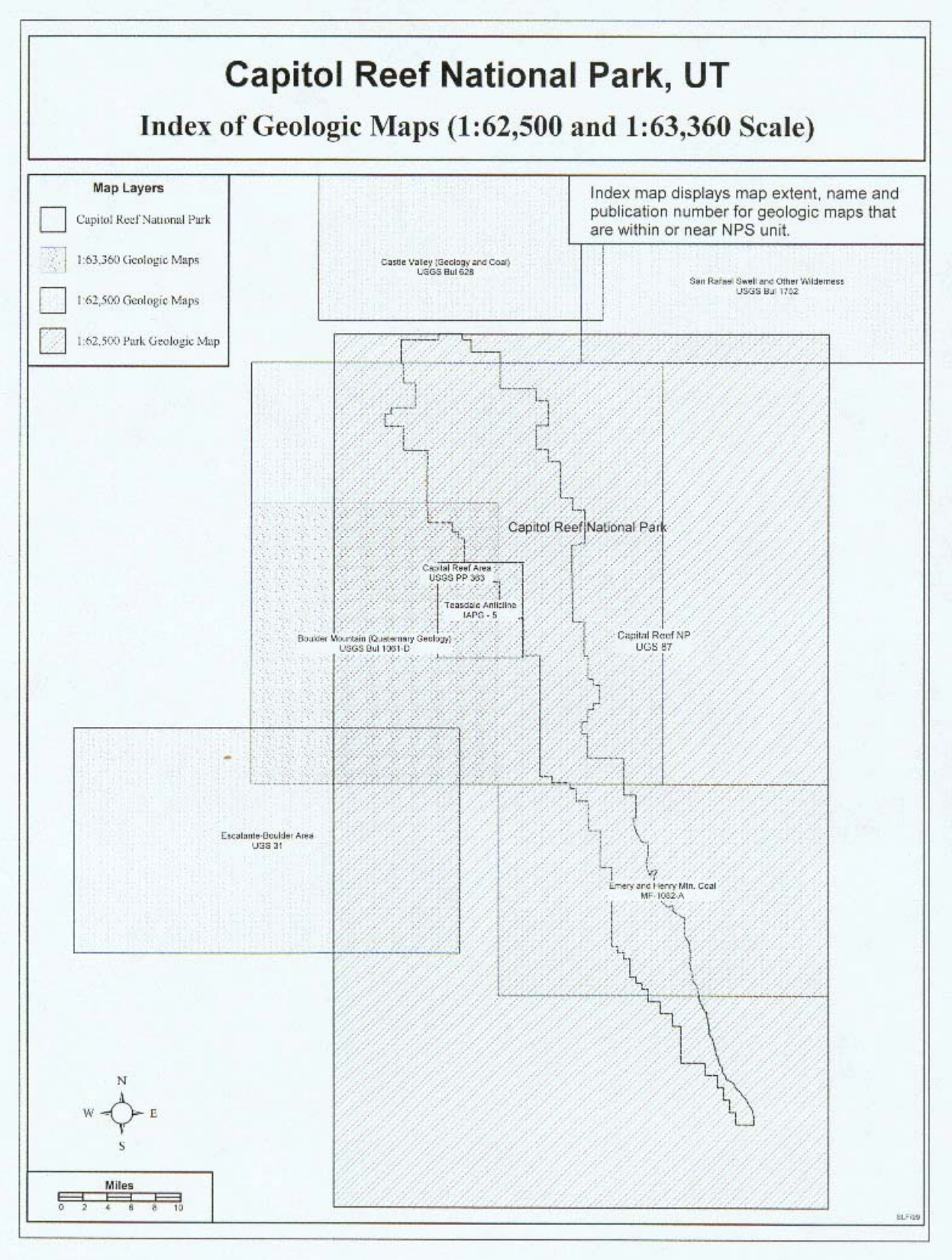

APPENDIX D
UGS Index of Quadrangle Maps, *1:100,000 scale*