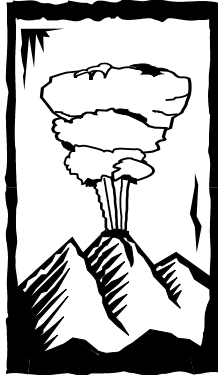


**Geologic
Resources
Division**



GRD



National Park Service

◆ **1999 - 2000** ◆

Biennial Report

Geologic Resources Division 1999 - 2000 Biennial Report

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◆ 1999 - 2000 ◆

Biennial Report

Geologic Resources Division



September 2001

United States Department of the Interior

National Park Service

Natural Resource Program Center

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Geology Digs In

By Michael Soukup, Associate Director

This publication provides a summary of the accomplishments of the Geologic Resources Division of the National Park Service in 1999-2000. As most readers know, the National Park System contains spectacular examples of the landforms and geologic features that make up our planet: the Grand Canyon and other features of world fame; dynamic geologic processes such as shorelines; vulnerable resources like cave systems; and highly prized specimens, including fossils and mineral crystals. Of the more than 380 National Park System units over 160 encompass significant geologic resources, at least 140 contain noteworthy fossils, 66 boast active shoreline geology, more than 75 include cave and karst systems, 49 have volcanic features, and 24 sit atop geothermal features. However, in the past, the public and many park managers have viewed these physical features as scenic backdrops to the plants and animals that exist within them. Despite the extensive geologic resources in parks and the importance of the physical environment to ecosystems, geology has often been inadequately accounted for in park planning, facility design, visitor safety, resource management, and visitor education.

With the creation of the Geologic Resources Division in 1995, NPS resource management rapidly began to include increased emphasis on geologic processes in park planning and management. Due to this attention to ecosystem management and awareness of natural systems interactions, the Service now recognizes the need for more scientific information in park management - including input from the geosciences. In addition to minerals management assistance, the Geologic Resources Division has functional responsibility for the earth sciences encompassing cave and karst systems, fossils, coastal processes, glaciers, landslides, soils, and other processes that form or act on geologic features. The Division has become an integral part of the Natural Resource Program Center which now supports park resource management through six technical divisions: Air Resources, Biological Resource Management, Environmental Quality, Natural Resources Information, Water Resources, and, of course, Geologic Resources.

Because successful resource management requires good science, the NPS has undertaken actions to improve resource management decision-making. In 1999, the Service launched a five-year initiative, the Natural Resource Challenge, to increase NPS professional expertise and access to scientific information and research. A budget increase in 2000, resulting from the Challenge, has allowed the Geologic Resources Division to provide park managers with a core set of geologic expertise. The Division now has 25 professionals who provide expert minerals and geology assistance to park managers across the National Park System. In addition, geologists are employed in various parks and offices across the country. These geoscientists are becoming an important part of an integrated approach to science-based resource management in parks.

Soon after it was established, the Geologic Resources Division began working to improve the parks' access to geologic expertise, training and information, and to secure funding for geologic resource management. America's National Park System has been described as the world's greatest set of outdoor classrooms. However, the educational value of those classrooms will be lost if we fail to recognize they are simultaneously the greatest set of natural laboratories. To build a network between the parks and geologic research community the Division established liaison offices in U.S. Geological Survey and built partnerships with geologic societies, universities and museums. The study of the extensive and diverse geologic features and processes in parks will give us an ever-expanding source of knowledge and information. The information that geologists can gather is much more than interesting facts and curious statistics. This information underlies our understanding of Earth's natural history and the context of the human experience. Knowledge of past ecosystems and Earth's processes will allow us to make informed decisions and inspire science-based decisions and actions outside park boundaries. ◆

Comments from the Division Chief

By David B. Shaver

This second edition of the Geologic Resources Division report series covers a pivotal period in the evolution of the NPS geologic resource management program. It was during the years 1999 and 2000 that the Division achieved a full complement of geologic expertise and matured to a fully functional geology program. The division now has the capability to provide the full range of geology, land restoration, and minerals management assistance to park managers across the National Park System.

The Geologic Resources Division was created in the 1995 NPS restructuring as part of the Natural Resource Program Center. At that time, the new Geologic Resources Division was charged with responsibility for the earth sciences encompassing cave and karst systems, fossils, coastal processes, glaciers, landslides, minerals management, soils, and other processes that form or act on geologic features. However, it was not until the initiation of the Natural Resources Challenge in 1999 and a resulting funding increase in 2000 that the division reached a full complement of geology specialists. With the hiring of new staff specialists, the division now employs 25 professionals in geology and minerals management - specialists in caves, coastal processes, geomorphology, mineral development, paleontology, petroleum geology, restoration, and regulatory policy.

While details of this broad-based geologic resources management program are provided later in this report, some of the significant accomplishments include:

- Institutionalizing a Servicewide disturbed land restoration program. Geology staff now coordinates a comprehensive restoration effort involving specialists from all Natural Resource Program Center divisions. In 2000, the program managed the distribution of over \$1.5 million in Servicewide funding to parks for restoration projects. Division staff also assists park managers with site assessments, development of restoration plans and project proposals, and on-the-ground project implementation. This program, an outgrowth and broadening of the 1998 abandoned mineral lands (AML) work, received funding from a Natural Resource Challenge-related increase for disturbed land restoration and a 2000 Fee Demonstration Project proposal. These restoration funds will be distributed annually to park projects on a competitive basis as part of the Natural Resources Unified Project Call.
- Convening several conferences and workshops to develop and facilitate a network of geologic experts and NPS staff involved in geologic resource management. A highlight was the April 2000 Geologic Resources Management Summit that brought together 50 natural resource managers and specialists from 35 parks and 4 Regional offices with division staff to assist in program development and strategic planning. Other events included: a symposium in Death Valley on geologic research and mapping with more than 60 presentations; a Coastal Workshop convening more than 100 NPS,

USGS and academic partners from Alaska to Florida held just outside Assateague Island National Seashore; and a Volcanic Workshop which brought together more than 75 scientists, educators, and resource managers at Lassen Volcanic National Park to address research, management, and interpretation of volcanic features in national parks.

- Commencing development of the National Cave and Karst Research Institute (NCKRI). In cooperation with the Intermountain Region, in 2000 the Division hired an Interim Director on a two-year detail to pursue establishment of the Institute, as mandated by the 1998 NCKRI Act.
- Coordinating efforts on geology-related NPS Strategic Plan goals. These performance management goals include the Servicewide disturbed lands restoration reporting and two new geology goals - for geologic process inventory and cave restoration/paleontology protection.
- Leading an interagency effort to develop a Report to Congress on Fossil Resource Protection. The Department of the Interior Appropriations Act mandated a report assessing the need for a unified federal policy on the collection, storage, and preservation of fossils on federal lands. Eight federal agencies were involved in preparation of the report. The Division's staff involvement put the NPS in a leadership role in preparing the report, which identified concerns about inventory, fossil losses, potential solutions, and the need for better protective legislation. Secretary Babbitt sent the final report to Congress on May 15, 2000.
- Fostering the Geologist-in-the-Parks program by placing about 50 geologists per year in parks to assist with geologic interpretation and education, mapping and inventory, and resource management. These geoscientists are improving our understanding of past geologic changes and unveiling the role geology plays in managing NPS natural resources. Key to the success of this program are partnerships the division has cultivated with organizations such as the Geological Society of America, the Association of Women in Geoscience, and the National Association of Black Geoscientists and Geophysicists.
- Developing numerous partnerships, both formal and informal, with state and federal geologic agencies, private geologic organizations, and academic institutions, to provide NPS managers with access to geologic expertise. In 1999 and in 2000, the Division used these partnerships with the U.S. Geological Survey, the Association of American State Geologists, several state geological agencies, academic, and private geology organizations to enhance the extent and quality of assistance that the Division can provide individual park units.
- Revising the NPS Management Policies and Natural Resources Reference Manual to address geologic resource management concerns. Previous versions of the management policies address geologic concerns only in a superficial way - the revisions give clear guidance on managing mineral rights,

disturbed land restoration, geologic resources, visitor safety, and physical processes.

► Providing expertise to the NPS minerals management efforts. This continued to be a core area of the division's technical assistance, with topics ranging from mining claim validity in Alaska and California parks, to oil and gas management in the new Tall Grass Prairie National Preserve as well as Big Cypress and national park units in Texas, to external mineral development threats to park resources and values, to NPS administrative use of sand and gravel in parks across the System.

Consistent with the tradition of the other Natural Resource Program Center divisions, the Geologic Resources Division is dedicated to providing leadership, high quality technical and policy expertise, and scientific support to the parks and to NPS management on geologic resource management and mineral development concerns. Division staff is extremely committed to these objectives, as evident by their dedication and hard work on a daily basis. I am proud of the division's accomplishments to date and look forward to continued program evolution in response to the needs of park resource management. ◆

New Geologic Resource Protection Expertise Added

The FY00 increase (+\$696,000) funded expanded geologic expertise in the Geologic Resources Division. Resource managers across the System had identified the critical need for geologic expertise to protect unique features and manage resources such as fossils, caves, and shorelines. Parks also recognize that effective restoration requires an understanding of the natural geologic setting. The division's base funded professional capability now includes cave and geologic inventory specialists, coastal geology, paleontology, and restoration geomorphology. These geoscientists will assist the more than 200 parks with significant geologic resources to survey, research, plan, and implement geologic resource protection projects.

Revisions of NPS Management Policies and Natural Resources Reference Manual #77

By Julia Brunner, Policy and Regulatory Specialist

The Division devoted a significant effort in 1999 and 2000 to the Servicewide revisions of the NPS Management Policies, Director's Orders (D.O.), and updates to various guidance documents and Reference Manuals (R.M.). Based on input from the field, our research and experience, and discussions with Department of the Interior Solicitors, the revised documents contain improved discussions about the technical and legal aspects of managing mineral rights, disturbed land restoration, geologic resources, visitor safety, and physical processes. Field personnel can now use these documents to more easily and effectively manage park resources.

Minerals

Mineral rights are explained in Chapter 8 of the Management Policies. The explanation in the former Policies was thorough, but needed additional revisions to resolve issues that have arisen since the former policies were issued. Chapter 8 now clarifies that prospective operators must prove to the NPS that they possess a property right. This chapter also explains that the NPS may initiate a validity examination of unpatented mining claims at any time, and that the Service, without exception, will determine a claim's validity before approving mineral operations on that claim. Validity examinations are performed on unpatented mining claims in order to determine if the mining claimant has a valuable mineral deposit under the meaning of the General Mining Law of 1872.

The administrative borrow materials section in Chapter 9 has also been updated to clarify that NEPA compliance and a finding of "non-impairment" must precede the extraction and uses of park borrow materials. The new language also encourages park units to develop and implement park-wide borrow management plans.

D.O. # 41 and R.M. # 41, which became effective in 1999, address wilderness management, including minerals issues. D.O. # 41 states that private mineral interests in wilderness must be managed pursuant to existing NPS regulations, policies, and procedures until they are acquired or relinquished. The D.O. further specifies that validity examinations in wilderness should include the costs of environmental mitigation necessary to preserve the wilderness character of the area, including possible restrictions on access or operations or additional costs of reclamation. R.M. # 41 reiterates these requirements and additionally clarifies that plans of operation for mineral operations in wilderness should contain stipulations that protect the wilderness character.

Disturbed Land Restoration

Previously, the Management Policies described restoration as a possible, but not a required, NPS activity. Chapter 4 of the new Management Policies has been revised to state a clear mandate for reestablishing natural processes in parks. An exception to this mandate occurs when Congress has directed otherwise.

A new section in Natural Resources R.M. # 77 addresses the physical aspects of disturbed land restoration. Developed as a team effort on the part of the Division policy and technical staff and restoration specialists throughout the NPS, the new section explains physical restoration in a step-by-step format. The new restoration section also explains how to address particular restoration situations such as abandoned mine safety and reclamation, restoration in wilderness, and well plugging projects.

Geologic Resources

Chapter 4 of the NPS Management Policies is devoted to geologic resource management. Prior to revision, the Management Policies mentioned geologic features only briefly, stating that they "will be protected" and that "certain" features would be monitored. The revised Management Policies define geologic resources as including both geologic features and processes, and require the NPS to manage all geologic resources by assessing the impact of natural and human-caused events, maintaining and restoring their integrity, and integrating their management into park operations, planning, and interpretation. The revised Management Policies state that, in most circumstances, the NPS will allow natural geologic processes to proceed unimpeded.

The former Management Policies mentioned only soils, caves, and shorelines as geologic resources. The revised Management Policies add helpful detail and clarification. For example, the revised Policies now define the term "caves." They also clarify that recreational use of some caves requires a permit, and explain the confidentiality provision of the Federal Cave Resources Protection Act. The revised Policies also discuss, for the first time, NPS management of karst systems and geologic hazards.

To further implement the revised Management Policies, the Division worked closely with the field to update the paleontology, soils, cave/karst, and geology sections of Natural Resources R.M. # 77. The most extensive updates were made to the geology section. This section now addresses geothermal resources, volcanoes, geologic interpretation, fluvial systems, recreational rock and mineral collecting and arid lands and Quaternary landforms in far greater detail than the former version. This section also discusses geohazard management and contains a list of park enabling statutes with references to caves, fossils, and other geologic features and processes.

A shoreline section was also added to Natural Resources R.M. # 77. This new section clarifies some definitions and facilitates the consistent use of shoreline terminology in the Park Service.

Visitor Safety and Physical Processes

Throughout the revision process, the Division tried to avoid using any language that could impact NPS liability for visitor safety. A good explanation of the NPS's management of visitor safety and protection can now be found in Chapter 8 of the revised Management Policies. Chapter 8 makes it clear that park resources are not only a visitor attraction, they are also potentially hazardous. However, visitor safety measures that may be appropriate outside of parks, such as erecting signs and fences and interfering with natural processes, are often inappropriate and impractical in parks. Interference with natural physical processes is particularly problematic since Chapter 1 of the new Policies now explains that such processes are among the "park resources and values" whose conservation is essential to the purpose for which the area was included in the national park system. For these reasons, Chapter 8 of the revised Policies clarifies that visitor safety is a matter of balancing various park policies and is therefore left to the discretion of park managers.

Conclusion

The purpose of the Division's efforts in 1999 and 2000 to revise, update, and draft various NPS Management Policies and other guidance documents was to provide park managers and staff with clear and usable tools for managing a variety of issues. These efforts would not have been successful had it not been for knowledgeable and enthusiastic field and regional office input. ◆

Natural Resource Preservation Program (NRPP) Adds \$2.875 million

The FY00 NR Challenge increase significantly augmented funds available for resource management projects in parks. These NRPP funds are allocated to regions for park projects based on a priority ranking process. This increase provided nearly \$1 million for additional park resource preservation projects, another \$1 million for disturbed lands restoration projects, and about \$500,000 each for Small Park projects and Threatened and Endangered Species projects in FY00.

The 2000 Geologic Resources Management Summit - Resource Managers and Specialists Unite to Support Geology

By Kerry W. Moss, Environmental Protection Specialist

For one week in April 2000, the Division hosted the "Geologic Resources Management Summit" in Colorado Springs, Colorado. The objective of the "Geosummit" was to bring together natural resource managers and selected resource specialists from the field, and Division staff to assist with program development and strategic planning for the Division. The impetus for the Geosummit stemmed from the Fiscal Year 2000 boost in the Division's funding for geology and disturbed lands staff and programs, increased emphasis on the Servicewide geologic resource inventory, growing geologic technical assistance requests from parks, and new geology-related Park Service GPR (Government Performance and Results Act) goals. Attendees included approximately 50 natural resource managers and specialists from 35 parks and 4 Regional offices. The entire Geologic Resources Division staff was also on hand for the Geosummit.

Sessions in the Geosummit ranged from geologic education to regulatory compliance to ecosystem restoration. Numerous presentations were given by park and regional personnel outlining a wide range of geology-related issues as well as several thought provoking case studies. After two days of park, regional, and Division presentations, the Geosummit transformed into a "workshop format" featuring breakout sessions organized by region and theme. These smaller work groups resulted in detailed discussions about caves, fossils, geologic hazards, shorelines, NPS sand and gravel, and disturbed lands restoration. Several informative posters displayed in meeting rooms also conveyed geologic themes and issues.

Division staff endeavored to capture the geologic interests and needs voiced by park and regional staff. This information was brought back to Denver at the completion of the Geosummit to be used by staff and managers in defining the most appropriate future direction for the Division's geology program. A distilled list of thoughts and ideas conveyed during the Geosummit was sent back to the participants in the weeks following the meeting. Further refinement of the ideas and goals between field and Division staff as the geology program continues to gain momentum will enhance the effectiveness and responsiveness of the Division in assisting parks in integrating geologic resource considerations in park stewardship. ◆

Geologic Resources Division Partnerships

By Bruce Heise, Geologist

The Geologic Resources Division maintains numerous partnerships, both formal and informal, with state and federal geologic agencies, private geologic organizations, and academic institutions. In 1999 and in 2000, the Division used these partnerships to enhance the extent and quality of assistance that the Division can provide individual park units. The major partnering organizations and highlights of our joint efforts are given below.

The Division provides a liaison to each of the three United States Geological Survey (USGS) regions. Lindsay McClelland serves as the liaison to the USGS Eastern Region and National Headquarters in Reston, Virginia. Bruce Heise is the liaison to the USGS Central Region in Denver, Colorado. Judy Rocchio with the Pacific West Region serves as the liaison to the USGS Western Region in Menlo Park, California. Each has different responsibilities and ongoing activities with the USGS offices.

U.S. Geological Survey Eastern Region and Headquarters

By Lindsay McClelland, Geologist

The USGS National Cooperative Geologic Mapping Program directs about \$2 million annually toward geologic mapping projects in parks. Eastern Region projects in 1999-2000 included geologic mapping and related research at Delaware Water Gap National Recreation Area, Chesapeake and Ohio Canal National Historical Park, George Washington Memorial Parkway, Shenandoah National Park, Great Smoky Mountains National Park, Everglades National Park, Biscayne National Park, Ozark National Scenic Riverways, and Buffalo National River. Issues addressed by the geologic mapping included landslide hazards, ecosystem composition, coral reef health, potential impacts of mining, karst aquifer protection, and geologic interpretation.

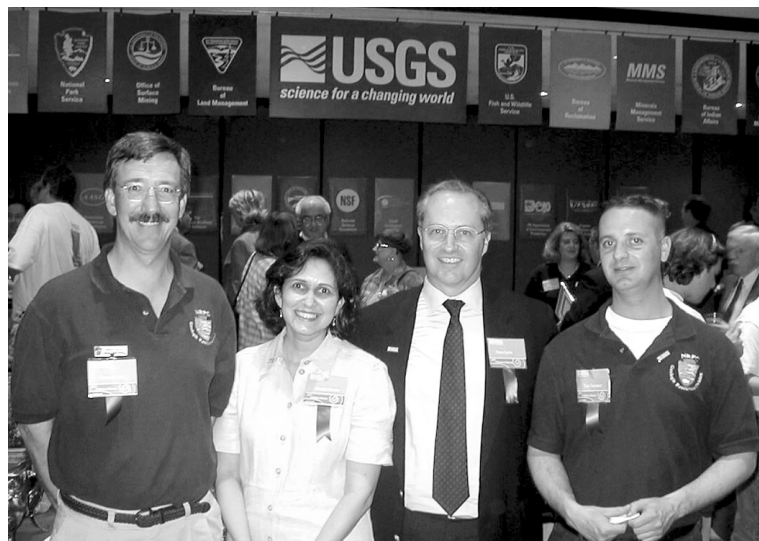
Work by the Geological Survey's Coastal and Marine Program provided key information in support of shoreline management at Cape Cod, Fire Island, Assateague, and Cape Hatteras National Seashores, and Sleeping Bear Dunes National Lakeshore. The Volcano Hazards Program is responsible for monitoring potentially active volcanoes, many of which are within national parks. Research and monitoring at Yellowstone National Park, Mt. Rainier National Park, Hawaii Volcanoes National Park, Aniakchak National Monument and Preserve, Katmai National Park and Preserve, Lake Clark National Park and Preserve, and Wrangell-St. Elias National Park and Preserve among others are designed to improve scientific understanding of complex volcanic systems and to provide early warning of impending eruptions.

In September 2000 Lassen Volcanic National Park hosted "Volcanism in National Parks: a NPS-USGS Workshop" in Redding, California, which included a field trip to Lassen led by USGS researchers and NPS resource managers (see separate article in this report).

U.S. Geological Survey Central Region

By Bruce Heise, Geologist

In 1999 and 2000, the Division partnered with the Geological Survey Central Region to meet park geoscience needs in a wide range of activities. Much of this support was in the form of geologic mapping, a necessary element of the NPS Geologic Resource Inventory Program (GRI; see separate article). USGS involvement was critical for the maps at Black Canyon of the Gunnison National Monument, Rocky Mountain National Park, Colorado National Monument, Golden Spike National Historic Site, Cedar Breaks National Monument, Lassen Volcanic National Park, Death Valley National Park, Craters of the Moon National Monument, Great Smoky Mountains, Wind Cave National Park, Jewel Cave National Monument, and Badlands National Park. The Division also provided support on completing maps at Yellowstone and Grand Teton National Parks. The Division brokered technical assistance requests between the USGS and Great Sand Dunes National Monument, White Sands National Monument, El Malpais National Monument, Lake Meredith National Recreation Area, and Katmai. Similarly, we were able to connect USGS scientists and specific parks on subjects ranging from interpretive posters to interagency agreements. The Division also worked with the USGS Minerals Team in preparing resource appraisals for Big Cypress National Preserve, Lake Meredith National Recreation Area, and Big Thicket National Preserve for use in oil and gas planning efforts at these parks. This information is used to prepare a reasonably foreseeable development scenario for impacts associated with oil and gas operations.



National Park Service and U.S. Geological Survey geologists at the Survey's open house in Reston, VA. A Park Service booth provides information on the NPS geologic resource inventory and digital mapping programs.

U.S. Geological Survey Western Region

By Judy Rocchio, Physical Scientist

The USGS/NPS partnership in the Western Region continues to evolve. In March 2000 USGS Western Regional Director, Doug Buffington, and scientists from all four USGS Western Region Divisions (Geologic, Water Resources, Biological Resources, and National Mapping) participated in the biennial West by Northwest 2000 Conference in San Diego. The theme of the conference was resource management and interpretation into the new millennium. Geological Survey scientists shared park specific scientific information during concurrent sessions and also participated in a candid plenary panel discussion addressing scientific information related to resources management and interpretation issues affecting a number of parks in the West. After the conference, USGS geologist Dave Miller and NPS geologist Marsha Davis led geologic site visits to four southwestern desert parks: Joshua Tree National Park, Mojave National Preserve, Death Valley National Park, and Lake Mead National Recreation Area. The primary goal of the park visits was to examine the geologic and geomorphic processes that occur in the desert in the context of current scientific understanding, discussing their role in ecological processes and implications for resource management. Discussions during the conference and sites visits have resulted in park project proposals being submitted for both NPS and USGS funding.

Nonfederal Organizations

The Association of American State Geologists and Individual State Geologic Surveys

State geologic surveys have become valuable partners in supplying technical assistance to the parks. Through cost sharing agreements, the Division is able to provide expertise on a timely and economic basis. Each year the Division presents an update of ongoing joint NPS-state survey projects at the Association of American State Geologists conference. In 2000 Division staff explained the history and components of the Geologic Resource Inventory and showed examples of where the NPS is working cooperatively with state surveys in Utah, Minnesota, North Carolina, and Colorado. State geologists for New Mexico, Montana, South Dakota, Kansas, and California all expressed an interest in future involvement and the Association requested a status report on the inventory at future meetings.

The Geologic Society of America

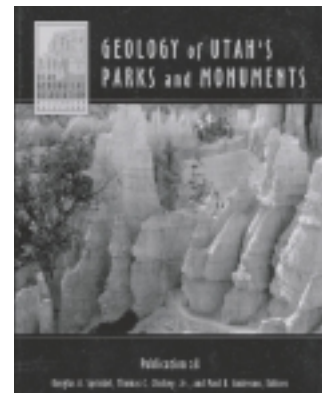
The Geological Society of America is the world's largest professional organization dedicated to geology. The Division has established close ties with the Society's education arm. Each year the Society hosts an annual convention attended by 5,000 to 6,000 geologists. For the past five years at the annual convention, the Division has had an exhibition booth providing information on research and employment opportunities in the Park Service, the Geologist-in-the-Park program, interpretation, education, and local park information. The booth routinely is one of the most heavily visited at the convention.

At the 1999 annual meeting, the Division proposed and chaired a session entitled "Geology, Bedrock of the Ecosystem; Biological Uses of Geologic Data." Over 20 papers were submitted. The selected papers addressed a wide range of topics from geological influence on marine and freshwater habitats, the geologic controls of the greater Yellowstone ecosystem to the fire history of an area as determined through examination of valley fill sediments.

At the 2000 annual meeting, the Division hosted a session entitled "Geology in Parks; Research, Mapping, Interpretation, and Education." Topics included discussions of park geology and field trip organization. As in 1999, it was highly attended. The Division has proposed a similar session for the 2001 annual meeting.

Utah Geologic Association

The Utah Geologic Association is a professional geologic organization serving the State of Utah. For its annual publication, the Association chose to publish a Millennium Guidebook on the geology of ten Park Service units in the state. The Division provided funding for the publication of the guidebook. In addition, the Division facilitated information transfer between the Association and the parks. The Association has provided the parks with limited copyright authority to use the geologic reports in public interpretive presentations.



Academic Institutions

The Division relies heavily on academic institutions to provide needed expertise on park technical assistance requests. Over the past two years, we have worked with the Colorado School of Mines on oil and gas development plans and on computer support. Denver University has provided assistance with digitizing maps, database research and maintenance, website design, and Geologist-in-the-Park interns. Brigham Young University, Southern Utah University, Colorado State University, East Carolina University, Guilford College (NC), Michigan Tech University, Idaho State University, Mesa State College (CO), Red Rocks Community College (CO), the University of Tennessee, University of Arizona, and the University of Minnesota all provided geologic mapping support for the Geologic Resource Inventory. The University of Akron provided geologic field trip guides for parks in Colorado and Utah. Georgia College provided assistance for park paleontological inventories. ◆

Disturbed Lands Inventory and Restoration: An Interdisciplinary Approach at Lassen Volcanic National Park

By Mark Ziegenbein, Geologist

Nearly all units of the National Park System have areas of surface disturbance, areas which have been physically modified by land users, even the National Park Service. Roads, gravel pits, abandoned mines, logged areas, buildings, dumps, dams, stream channel modifications, and drained wetlands are all examples of alterations to the natural land surface or surficial processes. Many of these altered land surface areas are no longer needed for park operations and are creating impacts such as: visual impacts; increased erosion and sedimentation; removal or alteration of vegetation, wildlife habitat, or cultural resources; contamination; and physical hazards.

In 1999, Lassen Volcanic National Park requested assistance from the Geologic Resources Division and the Water Resources Division to assess several disturbed land sites in the park and recommend actions to decrease or eliminate the associated adverse impacts. The two divisions assembled an interdisciplinary team comprised of a restoration geologist (Geologic Resources), a wetland hydrologist (Water Resources) and two restoration botanists (one from Point Reyes National Seashore and the other from the Denver Service Center).

The team assessed a total of 24 disturbed land sites ranging from small gravel extraction sites, trash dumps and abandoned housing areas to large rock quarries, a 90-acre drained wetland, a downhill ski area, an abandoned water treatment plant and a large section of paved road. Site inventories consisted of: locating each site on 7 ½' topographic quadrangle maps; tape and compass or pace and compass survey of site dimensions (if needed); photo documentation of site features; visual assessment of soil compaction; presence or absence of soil or growth medium; surface water flow and condition, erosional features and sediment contribution to surface waters, and restoration and revegetation potential.

The Geologic Resources Division and the Water Resources Division prepared a joint report entitled "Disturbed Land Inventory and Recommendations for Lassen Volcanic National Park." The report provides brief site descriptions and site maps; restoration design (if needed); itemized restoration tasks; and, equipment, time, and labor estimates for most sites. This inventory is intended to be the basis for a disturbed land restoration environmental assessment and a first step in the park-wide disturbed land restoration effort. The ultimate goal is to prioritize the park's disturbed land sites and to systematically restore all sites that are creating resource damage or conflicts.

The two Divisions are currently assisting four other parks with park-wide disturbed land restoration assessments: Big Bend National Park, New River Gorge National River, Fossil Butte National Monument, and Lake Meredith National Recreation Area. ◆



Terminal Geyser geothermal well - After plugging the 4000' deep well to protect nearby thermal features, NPS equipment is beginning to recontour the well pad and access road.

Erosion Mitigation on the Downhill Slide at Capulin Volcano

By David L. Steensen, Geologist - Restoration Program Coordinator

The National Park Service and the Federal Highway Administration are cooperating on a project to minimize erosional problems along one of the main facilities at Capulin Volcano National Monument, the Volcano Road. The Volcano Road spirals up the weakly welded cinder cone causing unnatural patterns of runoff. The unnatural runoff produces locally severe erosion, threatening the integrity of the road, accelerating the aging of the cone, and creating scars that can be seen from several miles away. All of these impacts are likely to have a negative influence on the visitor's experience. In 2000, at the request of the park, Division staff participated in several on-site reviews and is providing information to the Highway Administration design engineers, the National Park Service Intermountain Region and Denver Service Center planners, and to the staff at Capulin Volcano, about the geologic context, erosion and sedimentation response, and recent geologic history.

The current federal highway project is a starting point of a multi-phased effort to correct drainage problems. Long-term solutions may require new and/or different approaches to accommodating dominant erosional and sediment transport processes. Division staff provided suggestions to the Highway Administration engineers to further the development of potential long-term solutions. For example, the Division recommended the incorporation of one or more trench-drains in the design. Trench-drains have a grate that runs across the

entire road bench so that if the inlet plugs with sediment, the rest of the drain remains open and thereby reduces the potential to concentrate runoff at the next culvert down-slope. In addition, Division staff provided the park with a basic framework to develop a "road plan" by laying out a long-term comprehensive strategy for addressing continuing erosion problems. The cooperative working relationship with the Federal Highway Administration and the development of new techniques to address erosion and sediment transport issues at the park will likely be transferable to other parks faced with similar natural resource problems. ◆



Natural processes were not adequately accommodated during the design of the road at Capulin Volcano National Monument, causing numerous erosional problems. Cooperating with Federal Highway Administration engineers, Division staff provided geomorphic analysis that has led to a plan to reduce impacts to the road and downslope resources.

Division Teams up with Dinosaur National Monument and Federal Agencies to Address Major Road Erosion Problem

By Hal Pranger, Geologist

On November 9, 2000, Division staff met with Dinosaur National Monument natural resource and maintenance staff, Denver Service Center staff, U.S. Army Corps of Engineers, and U.S. Fish and Wildlife Service representatives to discuss options for protecting the Deerlodge Park Road. Deerlodge Park Road is the only access road into the eastern end of the Monument and could collapse into the Yampa River at any time because the Yampa River is moving laterally across its floodplain (see photo). In May 2000, maintenance staff constructed a temporary gravel detour road approximately 60 feet away from the existing road.

Based on a brief site investigation on June 29, 2000, Division and Monument staff agreed that it would be possible, and most desirable to construct a one- to two-mile bypass road around the problem area and remove the existing road. Realistically, however, funds are not available to construct a new road and remove the existing road without additional funding from Congress.

With the lack of funding for new road construction in mind, the NPS, the Corps of Engineers and the Fish and Wildlife Service discussed the possibility of stabilizing the bank of the Yampa River with upstream-oriented rock weirs or with riprap along the eroding channel bank. The rock weirs would be designed to impede erosion and encourage sediment

deposition and vegetation growth. The primary difficulty with any sort of river channel or bank stabilization measure is that Yampa River is prime habitat for endangered fish species. In addition, Chapter 4, Section 4.6.4 of the NPS Management Policies directs the Service to avoid impacts associated with floodplains, and protect stream processes such as erosion and sedimentation that create floodplains and channel pools. In addition, the NPS Organic Act and the Management Policies require that park natural resources be left unimpaired.

A representative from the Fish and Wildlife Service explained that Monument staff would need to submit a formal project plan before it could indicate whether the project might be permitted or not. Division staff also voiced concerns about how placing rock in the channel is inconsistent with the current NPS natural resource management policies mentioned above. Further, Division staff indicated that any structure placed in or along the channel eventually would be destroyed by the incessant migration of the Yampa River channel. Monument staff left the meeting with a commitment to address the issue in a timely manner, perhaps with further input from both Division staff experts and the Water Resources Division. ◆



View looking downstream (west) of the eroding left bank of the Yampa River and the Deerlodge Park access road on June 29, 2000.

Disturbed Lands Restoration Program

By David L. Steensen, Geologist - Restoration Program Coordinator

Overview - The National Park System contains over 575,000 acres in 195 park units that are disturbed by previous human activities and are targeted for restoration work. These disturbances include abandoned roads, dams, canals, railroads, grazed areas, campgrounds, mines, and other abandoned sites. Lands disturbed by human activity often cause unwanted and long-lasting problems that affect other park resources and facilities. For example, altered soils and landforms may affect biological communities and habitats in negative ways. Exotic plant invasion, unsightly scars, abandoned or unmaintained road networks, and abandoned mine sites, among many others, produce problems for parks attempting to manage areas as natural habitat.

Annual Program - In 1999, the Park Service used fee demonstrations to fund small restoration projects. In 2000, the Natural Resource Challenge contained new funding for restoration activities in parks. Through these sources of funds, the Division was able to acquire additional staff with earth science backgrounds and restoration project experience. The Division was also given the responsibility of managing the newly established Disturbed Lands Restoration project funds. These funds are a sub-element within the Natural Resource Preservation Program.

The addition of staff expertise and funding augments Division efforts at the Servicewide level, where staff provides coordination, oversight, and guidance in land restoration issues. As described below, the Division coordinates three primary activities targeted at helping parks with restoration work: project funding, technical assistance, and Servicewide information transfer.

Project Funding - In 1999, in anticipation of the budget increases described above, and with the approval of the Fee Demonstration proposal, the Natural Resources Unified Call included restoration funding categories for Fee Demo and Disturbed Lands restoration projects. Similar to other Natural Resources programs, parks submitted proposals to the Division, which then convened a panel of Regional representatives to rank the proposals. The Division distributed project funds based on the ranking of the competitive proposals. Division staff reviewed project work plans for technical adequacy and provided oversight in relation to cost accounting, accomplishments reporting, and the preparation of technical guidance.

Technical Assistance - The Division has specialists in surface reclamation, fluvial geomorphology, slope stability, and soil science. With this expertise, Division staff work cooperatively with Natural Resource Program Center staff in other divisions, and outside specialists to provide parks with:

- assistance with disturbed land inventories, site characterizations, resource impact assessments, and issue identification;
- analysis of human health and safety hazards and develop-

ment of mitigation designs;

- assistance with developing proposals for funding;
- geomorphic and geologic analyses, volumetric surveys, development of materials and equipment, and cost estimates;
- landform restoration designs, engineering specifications, well-plugging specifications, and contract scopes-of-work;
- project oversight assistance; and,
- facilitation of access to multidisciplinary expertise for natural systems restoration and conservation of critical habitat.

In 1999 and 2000, Division staff helped 29 parks carry out restoration activities. Projects ranged from reclaiming a parking lot at Jewel Cave National Monument, to reclamation of the White Bird Battlefield at Nez Perce National Historical Park.

Servicewide Coordination - In accordance with the Government Performance and Results Act (GRPA), parks report performance to Servicewide GPRA Goal Ia1A, which involves restoring parklands disturbed by land use. These are areas where past land uses have significantly altered the landscape that the park intends to restore. Examples of such land use include: abandoned structures, abandoned roads, abandoned mines, permitted mining activities, administrative

Division Increases Availability of Disturbed Lands Reclamation Program Assistance

In FY2000, the Natural Resource Challenge included new funding for the Division to support restoration activities in parks. Accordingly, the Division hired geologists, Deanna Greco and Harold Pranger, to assist parks with land restoration projects, surficial process and natural resource issues, and support for Servicewide restoration programs.



Deanna Greco



Hal Pranger

Deanna comes to the Park Service from the Bureau of Land Management in Coos Bay, Oregon. Hal comes from the Office of Surface Mining. The addition of their expertise greatly enhances the capabilities of the Division and the Natural Resource Program Center to help parks with issues related to disturbed lands restoration and surficial geology issues.

use of sand and gravel, abandoned campgrounds, abandoned trails, and other abandoned sites or facilities targeted for restoration. Division staff involved with GPRA Goal Coordination provided technical guidance to central offices and parks.

In 2000, the Division spearheaded the effort to establish a restoration technical advisory group within the NRPC. This

group assures interdivisional cooperation and coordination in addressing park specific restoration projects.

Program Needs - The NPS estimates that to restore priority areas over the next 5 years would require \$65 million. Long-term restoration costs could be as high as \$250 million. ◆

2000 Disturbed Lands Restoration Project Activities

The Disturbed Lands Restoration Program provided \$1,073,000 to parks to restore disturbed areas using new Natural Resource Program Center Disturbed Lands Restoration Funds. Throughout six regions, these monies funded 18 separate projects at 18 parks. The following table shows the projects funded in FY2000:

Region	Park	Project Title	NRPP-DLR Funds
Alaska	Denali	Caribou Creek Restoration	\$51,000
Intermountain	Rocky Mountain	Rehabilitation of the Lawn Lake Dam	\$250,000
	Wupatki	Borrow Pit Reclamation Planning	\$9,000
	Pecos	Restoration of Glorieta Creek	\$3,600
	Rocky Mountain	Restoration of Willow Plant Communities	\$11,900
	Zion	Virgin River Restoration Planning	\$24,000
Midwest	Buffalo River	Stream Restoration, Boxley Valley Historic Zone	\$88,000
	Apostle Islands	Restore the Oak Island Sandscape	\$7,000
Northeast	New River Gorge	Inventory Abandoned Mine Sites	\$30,000
	Moore's Creek	Wetlands Restoration Planning	\$2,800
	Fire Island	Plugging of Abandoned Water Wells	\$14,700
	Fredericksburg-Spotsylvania	Milstead Pond-A Wetlands Restoration	\$25,800
	Cape Cod	Tidal Wetlands Restoration Assessment	\$50,000
Pacific West	Mojave	Rainbow Wells Restoration	\$100,000
	Great Basin	Disturbed Lands Restoration at Bonita Mine	\$82,200
	Golden Gate	Lower Easkoot Creek Restoration	\$73,000
Southeast	Big Cypress	Disturbed Lands Restoration at the Headwaters of Turner River	\$50,000
	Jean Lafitte	Backfill Dead-End Oil & Gas Canals	\$200,000
Total NRPP-DLR Project Funds			\$1,073,000

The Disturbed Lands Program provided \$181,800 to parks for disturbed area restoration using 20% Fee Demonstration Funds. This money funded 7 separate projects at 6 parks throughout three regions. The following table shows the projects funded in FY2000:

Region	Park	Project Title	Fee Demo-DLR Funds
Intermountain	Hubbell Trading Post	Pueblo Wash Riparian Restoration	19,800
	Florissant Fossil Beds	Dam Removal	32,000
	Glacier	Restoration at Logan Pass	22,500
Northeast	Fredericksburg-Spotsylvania	Restore Wetlands, Milstead Pond-A	50,000
Pacific West	Pinnacles	Entrance Meadow Restoration	28,200
	Lake Roosevelt	Restore Agricultural Field to Natural Conditions	10,300
	Pinnacles	Rehabilitate Climber Access Routes at Bear Gulch	19,000
Total 20% Fee Demonstration-DLR Project Funds			181,800

Geohazard Assessments in Parks

By Philip Cloues, Mining Engineer

Throughout 1999 and 2000, the Division provided technical rock mechanics and safety engineering assistance to many park managers for the assessment of a variety of geohazards in National Park System units. The goal of assessing geohazards is to minimize property damage and injury to visitors and staff. The following information presents a summary of some noteworthy technical assessments completed during this time.

Cumberland Gap National Historic Site - The NPS recently purchased a privately owned cave located in park boundaries. The site is known as Cujo Cave. Prior to opening the cave for visitation, Cumberland Gap management and staff determined the facility needed a certain amount of "upgrading" prior to being open to the public. The park Chief of Natural Resources requested review of a conceptual design plan for a cave entrance support system. A 1999 rock fall drew attention to the need for construction of a support system for the cave entrance. The entrance has undergone considerable human disturbance this past century. Following technical recommendations supplied by the Division, the park plans to construct an engineered support system to resolve the potential problem of rock falls and reduce the risk to visitors from future incidents due to the weathering forces of nature.



Cudjo Cavern main entrance collapse at Cumberland Gap National Historic Park, KY.

Pipe Spring National Monument - "Plumbing problems" in the famous springs at Pipe Spring National Monument punctuated the need for a meeting and field inspections of an underground water flow problem. The park asked for the meeting and inspections in an effort to determine the possible causes and solutions for the springs that are drying up. Specialists from the US Geological Survey and the National Park Service met on September 27 and 28, 1999, to present hydrologic research, seismic surveys, and water data in hopes to resolving the current problem of Tunnel Spring roof

collapse and dry springs at the "castle." Stabilization is a first step in long-term spring utilization. A scope of work containing general design criteria to send to potential contractors was formulated by a team and presented to the park for consideration. The park selected a contractor through a competitive process and construction of a new portal system and clean out of the collapsed area is in progress.

Hot Springs National Park - Loose rock tumbled down the hillside endangering workers and the cooling-tower facility at the base of the slope signaling a slope stability problem at Hot Springs. In 1999 staff from the Division coordinated an investigation to determine the root cause of the stability problem. The rock falls are caused by modifications to the natural terrain during historical settlement of the area. These modifications destabilized the hillside and natural weathering processes exasperated the stability problem. The Geohazards Team of the U.S. Geological Survey sent a qualified scientist to evaluate and document the findings of the stability problem. A specialized geotechnical firm provided options to mitigate the problem. The team recommended interim safety precautions consisting of air monitoring, warning signs, and instruction until the park could secure funds to minimize risk to property, workers, and visitors. The team effort provided a rapid response to a potentially very serious situation. Fortunately, there is a reasonable solution to the problem consisting of pinned cable nets that should stabilize the hillside and allow the cooling tower to remain in its current location.

Carlsbad Caverns National Park - At the park's request, the Division made recommendations on possible actions to stabilize road cuts along the access road to park facilities. Preventative maintenance work along the road will reduce the risk of potential rock falls from natural weathering processes in two areas that merit attention. The Iceberg Rock geohazard involved the collapse (no injuries) of about 5 tons of rock onto the trail within the cave. The rocks were from an overhead area hand-stacked by the Civilian Conservation Corps in the early 1930s. The cleanup process removed the trail blockage as well as stabilized any remaining potential problem areas.

Geologic hazards pose a constant threat in NPS areas where geologic features are often the primary reason for the creation of many of our units in the National Park System. At the very least, geologic features often play an integral role in the siting of park roads and facilities. The Division plans to continue providing assistance to park units that find it necessary to mitigate geohazards. Teamwork among parks, the Division and geology experts from other government agencies has proven to be an effective way to deal with the geohazards issue. ◆

Landscape and Cultural Scars Healed at Nez Perce War Battlefield

By Hal Pranger, Geologist

In the Fall of 2000, Division staff collaborated with Nez Perce National Battlefield staff, the Idaho Army National Guard, the 116th Engineer Battalion and representatives of the Nez Perce Tribe to reshape an abandoned sand and gravel pit located at the heart of the White Bird Battlefield. This site was the location of the first battle of the Nez Perce war that began in 1877. During this short battle, Nez Perce tribesmen convincingly routed United States soldiers. The two-acre sand and gravel pit is surrounded closely by countless valuable cultural and historic resources. The Nez Perce tribe considers the site sacred.

Restoration was necessary because the pit was unsightly and covered with noxious weeds and a relatively large number of visitors pass next to the pit along an access trail. The continued presence of the pit was incompatible with current NPS natural and cultural resource policies. The restoration project was designed to return the area to its natural contour. This entailed pulling unused sand back into the pit, cutting the pit walls back to blend inconspicuously into the surrounding landscape, covering the site with stockpiled topsoil, and then reseeded it with native plants.

Division staff designed the restoration plan in May 1997 and supervised the earthwork in September 2000. The National Guard provided the earthmoving equipment and the equipment operators, treating the project as a training exercise. Dan Foster, Resource Management Specialist at the Battlefield, managed the overall project, including an archaeological survey of the site, the schedules of the various entities, the fire control plan and the revegetation of the site. A wildfire came within one mile of the site while the work was being completed. Nez Perce tribal representatives approved the plan and conducted a ceremony at the site immediately after the project was completed. ◆



View of the abandoned sand and gravel pit at the White Bird battlefield on September 8, 2000, before restoration work began.



View of the National Guard reshaping the sand and gravel pit at the White Bird battlefield on September 9, 2000.



View of the reshaped sand and gravel pit at the White Bird battlefield on November 14, 2000, immediately after reseeded.

Erosion of Trails and Streambanks at Morristown National Historical Park

By Deanna Greco, Geologist

The Continental Army spent two winters during the Revolutionary War in Morristown National Historical Park, located in Morristown New Jersey. The park contains several historic structures as well as over 27 miles of hiking trails. Park staff had concerns about the effects of erosion on the protection of these historic sites, trail surfaces, and on streams and invited the Division to advise them.

These sites have been heavily impacted by deer leading to the loss of the naturally developed understory and native plant species. The result has been a proliferation of exotic plant species. Aggressive exotic species such as Japanese barberry have the ability, once established, to suppress native species. The lack of understory in the park has led to the erosion of forest soils. This is evident in the area along the Passaic River where erosion has exposed the root masses of large deciduous trees.

In 2000, Division staff visited the park to witness the physical impacts of overpopulation of the deer and of the infestation of the barberry on park resources. There is a need to eradicate these exotic species as well as control the deer populations to manageable levels. Removal of these exotic plant species poses several related issues that were discussed with park staff. These issues include:

- There is a potential for accelerated surface erosion if Japanese barberry is removed in large numbers (several acres at a time).
- Japanese barberry tends to lower the soil pH in areas where it grows. Thus, removal may impede the establishment of native species and require the addition of soil amendments.
- It has been suggested to the park that a prescribed burn program could control the barberry. Fire test plots have been proposed in the park to determine if it would be effective in controlling exotics. The natural fire history of the surrounding forests should be examined as well as what the effects of a prescribed burn would have on the thin soils of the area.

Division and park staffs looked at seven sites as representative of the issues facing the park. The sites included a segment of the Passaic River that flows through Morristown, a reclaimed landfill, a cultural site (Soldier Hut), a trail around reconstructed soldier huts (Pennsylvania Brigade Area), the New York Brigade Trail, and two abandoned mine sites. Division staff recommended that the park establish an erosion monitoring program to provide information that will assist park management in dealing with overgrazing by deer populations, exotic species, and the resultant accelerated erosion from these impacts. ◆

Emergency River Restoration Assistance, Pinnacles National Monument, California

By Hal Pranger, Geologist

In 1998, a large flood scoured away approximately 500 linear feet of the floodplain of Chalone Creek and filled approximately 750 feet of the channel with sediment. Initial restoration efforts exposed material from an old municipal waste dump in the floodplain which had been partially scoured away during the flood. Removal of the waste material and restoration of the stream channel proved to be a larger project than anticipated.

In October 2000, Geologic Resources Division staff and staff from Pinnacles National Monument cooperatively devised an emergency plan to repair flood damage along the creek. All the participating state and federal agencies had to develop and approve the plan and complete an analysis under the National Environmental Policy Act prior to construction. Chalone Creek, the largest stream flowing through the Pinnacles National Monument, flows only from about December through May. Therefore, the park had to remove the sediment and waste and restore the channel and floodplain before the next high flow season.

The Division reviewed and made minor corrections to the initial restoration plan developed by Monument staff. The plan consisted of four main elements. First, the sediment that accumulated in the main channel had to be removed. Second, the scoured floodplain needed to be reconstructed. The sediment excavated from the main channel would then be used to partially fill in the scoured floodplain. The park would import additional clean fill and soil material to restore the floodplain to its approximate original configuration. Third, the floodplain and stream channel required erosion protection. Woody debris in the area from past floods and small rock dikes would be used to protect the channel bank and the edge of the floodplain. Finally, develop a monitoring plan for Chalone Creek to determine the success of the project and to determine whether further remedial actions are necessary. Monument staff was able to complete the project before the stream channels began flowing. ◆



View of the reconstructed Chalone creek stream channel where severe flood damage occurred in 1998.

Geologic Impacts on Cultural Resources, Petersburg National Battlefield, Virginia

By Hal Pranger, Geologist

In August 2000, Division staff, in cooperation with park staff and Dr. Rick Bergquist of the College of William and Mary and the Virginia Geological Survey, evaluated the geology of the following two historic sites at Petersburg National Battlefield: the Crater site and City Point. The purpose of the visit was to answer two major questions: (1) What made tunneling at the Crater site so difficult for Union troops during the American Civil War? And, (2) What is the risk and potential loss of the vast cultural resources on the City Point bluff due to erosion? A broader goal of the visit was to initiate efforts to develop a detailed geologic map of the Battlefield.

The Crater site demonstrates how geologic conditions can affect a battle strategy. Union troops tunneled behind Confederate lines and detonated dynamite, creating the "Crater." However, digging the tunnel was extremely difficult. Halfway into the excavation the soldiers encountered material that was nearly impossible to remove with pick axes. They called the material "marl." The soldiers angled the tunnel to go up and over the marl and then continued excavating the tunnel at a shallower depth in looser material.

Before the site visit, Division staff postulated that the marl might be associated with faulting in the area. However, drilling revealed that Union troops tunneled into a dense, impermeable, sticky clay from an abandoned channel deposit at the Crater site. The clay was deposited about three million years ago in a stagnant lake bed.

The City Point site is considered by some to be the single richest archaeological and historic site in eastern North America. City Point is located on a bluff between the confluence of the James and Appomattox rivers. For thousands of years, the bluff provided humans protection against enemies and floods and served as an ideal location to obtain food and water. The site also was an early European settlement as well as General Grant's headquarters during the Civil War.

The Division found that the City Point bluff has not eroded substantially since the Civil War. However, we predicted that the bluff will begin eroding at an accelerating rate in about 30 to 100 years, when the rapidly rising sea level reaches a loose sandy layer near the base of the bluff. Stabilizing the bluff is possible but would be very costly and require perpetual maintenance. Large stabilization structures would be incompatible with current NPS natural resource protection policies. Extensive erosion will likely occur at City Point in the long term. However, because the bluff likely won't soon experience severe erosion, Division staff recommended that the park expend its efforts and dollars studying the site's cultural resources and rather than stabilizing the bluff. ◆



Dr. Bergquist and Petersburg National Battlefield personnel drilling a core hole at the Crater site. The tunnel lies below the area between the path and the drill.

Disturbed Land Inventory at Wupatki National Monument

By Deanna Greco, Geologist

Wupatki National Monument (WUPA), established in 1924 by Presidential Proclamation No. 1721, has a complex administrative history of road construction, closure, and maintenance. Borrow pits were used as a source of material for construction and maintenance of these roads within the park. The use of borrow pits has changed over time and the associated surface disturbance is no longer desired. The park would like to restore these areas to reduce or eliminate adverse impacts and restore natural processes to the extent possible.

In 2000 Wupatki National Monument requested assistance from the Geologic Resources Division to assess several disturbed land sites in the park and recommend the actions needed to decrease or eliminate adverse impacts. To accomplish this task, staff from the park and the Division formed an interdisciplinary team comprised of two restoration geologists (GRD) and a vegetation ecologist. The visit and subsequent report constitute the first steps in a park-wide disturbed land restoration effort. The ultimate goal is to identify and prioritize the disturbed land sites, develop restoration plans for each site, and then restore these sites. Site inventories consisted of locating each site on a 7 ½' topographic quadrangle map, tape and compass or pace and compass survey of site dimensions (if needed), photo documentation of site features, visual assessment of soil compaction, presence or absence of soil or growth medium, surface water flow and condition, erosional features and sediment contribution to surface waters, and restoration and revegetation potential.

Monument staff compiled an initial list of 12 priority sites requiring rehabilitation and restoration of the borrow pits to a more natural state.

Several of the borrow pits are located adjacent to archeological sites. In the western portion of the Monument, borrow pits are located immediately adjacent to large pueblos with standing architecture. These surface disturbances have, in some cases, increased erosion and altered the visual impacts of the cultural resources. Along the Little Colorado River, surface disturbances from the borrow pits have created habitats for exotic plant species which threaten nearby riparian environments.

The completed report entitled "Disturbed Land Inventory and Recommendations for Wupatki National Monument" provides brief site descriptions, site maps, restoration design (if needed), itemized restoration tasks, and equipment, time and labor estimates for most sites. This inventory will be the basis for a disturbed land restoration environmental assessment and a first step in the park-wide disturbed land restoration effort. The ultimate goal is to rank the disturbed and sites and to systematically restore all sites that are creating resource damage or conflicts. ◆



Survey of abandoned borrow site at Wupatki National Monument, AZ.

Evaluation of Road System at Shenandoah National Park

By Deanna Greco, Geologist

Shenandoah National Park is located along a narrow section of the Blue Ridge Mountains. One of the dominant land forming processes is mass wasting, primarily in the form of debris flows. A June 1995 storm in Madison County demonstrated how rainfall can trigger mass wasting activity. A subsequent study revealed that, "[S]urficial deposits, exposed in debris-flow channels scoured by extensive runoff during the June 1995 storm in Madison County, provide evidence that the area has been subjected to repeated episodes of debris-flow activity" (Morgan and others, 1997). This suggests that these are not unique events but rather, a natural, frequent process of the Blue Ridge Mountains.

The park invited Division staff to assess options for mitigating the impacts that mass wasting occurrences have on the park's road system. As part of that effort, the Division agreed to undertake a roads analysis of the park. A roads analysis is a procedure for planning further protection or management, including restoration practices within a watershed. It can provide a framework for considering benefit to cost in a watershed context. Restoration should be based on road analysis and planning. This is essential to identify areas of the greatest likelihood of success.

Prior to the establishment of the park, the road network supported homesteading and timber harvest. Further road development served visitor and park personnel access needs. The road system has altered the character of the landscape. Constrictions such as bridges and culverts create logjams and blockages. Diversion of flow around these blockages shifts the hazard to other adjacent areas. In addition, road fills may contribute to slope instability as well. Road fills are highly compacted and disrupt natural hydrologic processes. These hazards create one of the biggest challenges of managing a road system in Shenandoah National Park.

A roads analysis will help identify areas of hazard. Without an active program to identify and correct road problems, habitat damage and effects to downstream neighbors can continue for decades. Well-established practices to control and prevent road generated erosion and peak flows can drastically reduce risks of future habitat damage and park liability to surrounding communities and residents. In most watersheds containing high quality habitat and downstream private ownership, large amounts of that habitat can be protected and natural flow conditions can be maintained with minor investments. Road treatments can range from full decommissioning to simple road upgrading. Decisions to apply a given treatment depend on the value of downstream uses, transportation needs, social issues, costs, and other factors. Upgrading may involve practices such as removal of earth from locations with high potential for landslides, modification of road drainage to reduce the likelihood that a road is acting as an extension of the stream network, and reconstructing stream crossings to reduce the risk and consequences of failure.

In 2000, the Division prepared a report which provided a draft roads analysis outline tailored for Shenandoah National Park. The park plans to use the outline to guide efforts to determine the impact of roads to the environment while balancing the need for roads for fire protection, law enforcement, and resource management. The roads analysis outline will provide a valuable park tool for determining if roads should be maintained, upgraded, or closed. ◆

Abandoned Mineral Lands Reclamation Program

By David L. Steensen, Geologist - Restoration Program Coordinator

Annual Program

Fiscal Years 1999 and 2000 marked the second and third years of dedicated funding for the Servicewide Abandoned Mineral Lands (AML) reclamation program. A successful budget initiative in 1998 enabled the NPS to direct project funding specifically toward the reclamation of degraded lands and waters and the mitigation of safety problems at priority AML sites. The Geologic Resources Division administers the Servicewide AML reclamation program and provides national-level coordination, oversight, and guidance. Under the Program, the Division also administers three primary park-specific activities - project funding, technical assistance, and Servicewide information transfer.

Project Funding - Through the AML Program, the Division distributes project funds to parks based on the relative rankings of the competitive proposals. Division staff reviews project work plans for technical adequacy and provides oversight in relation to cost accounting, accomplishments reporting, and the preparation of technical guidance.

Technical Assistance - The Division has in-house specialists in surface reclamation, underground mine safety, mining engineering, and petroleum engineering. Division staff works directly with parks to provide:

- assistance with AML inventory, site characterization, resource impact assessments, and issue identification;
- analysis of human health and safety hazards and development of mitigation designs;
- assistance with developing proposals for funding;
- geomorphic and geologic analyses, volumetric surveys, and development of materials and equipment cost estimates;
- landform restoration designs, engineering specifications, well-plugging specifications, and contract scopes-of-work;
- project oversight assistance; and,
- facilitation of access to multidisciplinary expertise for natural systems restoration and conservation of critical habitat.

Servicewide Information Transfer - The Division manages the Servicewide AML database and in 1999 realized progress in updating the database to a modern platform (Access). The update enables easier database management and reporting activities. The next step is to make the database available on the NPS intranet so parks may easily inspect and update the information as necessary.

Background

Overview - The National Park System contains nearly 3,000 sites in 146 parks that have been disturbed by previous mineral exploration and development. These sites include 11,000 underground openings, 51 abandoned oil and gas wells, and 33,000 acres of scarred surface area. These figures do not include the extensive areas of disturbed lands added to the

system by the California Desert Protection Act of 1994 (16 U.S.C. §410aaa). Resource effects include excessive erosion and sedimentation, exotic plant invasion, soil and water contamination, and public safety hazards.

Goals - The NPS began collecting information about abandoned mineral lands on a Servicewide basis in 1984. Since that time, the NPS has nearly completed a Servicewide AML inventory and has set priorities for site mitigation and restoration. From these efforts, the Division identified the following objectives for an AML Program: (1) inventory all AML sites, (2) restore degraded natural resources, (3) eliminate safety hazards, (4) preserve and interpret culturally and historically significant resources, and, (5) protect critical habitat. The current program directly addresses goals 1, 2, 3, and 5; goal 4 is addressed indirectly by coordination with other NPS personnel.

Partnerships - The NPS has entered into Cooperative Agreements with eight states and has Memoranda of Understanding with two federal agencies to conduct environmental characterizations and to focus funding toward on-the-ground reclamation. Before 1998, these efforts directly contributed to restoring 85 AML sites, closing (mostly temporarily) 766 mine openings, and plugging 34 orphaned oil and gas wells. These accomplishments primarily used external funds. Cost-sharing and access to technical expertise also continues to complement the new funding for the Park Service AML Program.



Staff inspecting bat gate closure installed at Brooklyn Mine, New River Gorge National River, West Virginia.

Program Needs - The NPS estimates that to address its priority needs related to abandoned mine lands over the next 10 to 20 years would require a total of \$20 million to \$40 million. Long-term reclamation costs could be as high as \$165 million. The Division has submitted budget initiatives, annually since 1987 with mixed success, to address resource and safety concerns at AML sites.

The examples on the following pages highlight the range of projects completed in 1999:

Denali National Park & Preserve - Eureka Creek Restoration

Excerpted from Ken Karle, Denali National Park

Cleanup of Eureka Creek included the removal of abandoned mining equipment, assessment and removal of hazardous wastes, removal of mining camp debris, and reconstruction of highly disturbed segments of a stream channel and floodplain. Resource conflicts along Eureka Creek included an abandoned mining camp and equipment, barrels with various quantities of (initially) unknown substances scattered

throughout the site, and a severely altered stream channel with unstable bed and banks. Similarly, the floodplain was virtually nonexistent, with a large windrow of tailings running down the center of the valley, separating the active channel from a mining overflow channel. The project reduced or eliminated the threats to water quality, improved recovery of riparian habitat, restored channel and floodplain functions, and removed threats to visitor health and safety.

1999-2000 AML Program Activities

In FY99 the NPS AML Program provided \$163,800 to parks for mine site reclamation, habitat conservation, and AML site characterization and planning for future work. The table below lists the ten separate projects funded at seven parks throughout five Regions with those funds.

Region	Park	Project Title	1999 AML Program Funds
Alaska	Wrangell-St. Elias	Bremner District: Mine Opening Hazard Remediation	\$ 15,800
	Wrangell-St. Elias	Kennicott Mine Opening Survey And Safing Design	\$ 5,000
	Wrangell-St. Elias	Horsfeld & Baultoff Abandoned Mining Camp Reclamation	\$ 12,000
	Denali	Reclamation of The Eureka Creek Watershed	\$ 24,000
	Denali	Reclamation of the Red Top Mine	\$ 16,000
Intermountain	Pecos	Restore Glorieta Creek Reservoirs to Native Floodplain	\$ 20,000
Midwest	Buffalo River	Construct Mine Gates: Monte Cristo Complex	\$ 20,000
Northeast	Fredricksburg-Spotsylvania	Close & Reclaim the Hazel Grove Iron Mine at Chancellorsville	\$ 5,000
Pacific West	Joshua Tree	Manage Abandoned Mine Lands: Golden Eagle Restoration	\$ 11,000
	Great Basin	Inventory and Reclamation Of Abandoned Mine Lands	\$ 35,000
Total AML Project Funds			\$163,800.00

In Fiscal Year 2000, the Park Service AML Program provided \$276,600 to ten parks throughout six Regions, shown in the following table:

Region	Park	Project Title	AML Program Funds
Alaska	Wrangell-St. Elias	Kennicott Mine Closures	\$24,000
	Wrangell-St. Elias	Abandoned Mining Camp Reclamation	\$12,500
Intermountain	Saguaro	Bat Gate Design and Installation	\$6,200
Midwest	Sleeping Bear Dunes	Restoration of the Norcronk (Scussel) Pit	\$31,000
	Buffalo River	Construct Mine Gates: Rush Mining District	\$27,800
Northeast	Allegheny Portage	Characterize Acid Mine Drainage	\$18,600
Pacific West	Nez Perce	Reclaim the White Bird Battlefield	\$21,400
	Joshua Tree	AML Reclamation, Crown Prince Mine	\$30,800
	Great Basin	AML Reclamation, Lexington/Ponderosa Mines	\$24,300
	Mojave	AML Site Inspections	\$35,000
Southeast	Big South Fork	Remediate Contaminated Mine Drainage	\$45,000
Total AML Project Funds			\$276,600.00

Fredericksburg & Spotsylvania National Military Park - Removal of Non-Historic Iron Mine at Hazel Grove

Excerpted from Michael Johnson, Fredericksburg & Spotsylvania National Military Park

Reclamation was undertaken to the entrance of the non-historic Iron Mine at the Hazel Grove area, at the Chancellorsville Battlefield unit which many historians believe to be the greatest victory of the war for the South. Resource conflicts included about 1,800 square feet of disturbed surface area surrounding the mine opening, detracting from the historic context. The mine also presented a hazard to the safety to both visitors and employees due to its proximity to an interpretive trail, especially since the vegetation near the edge obscured the mine. Maintenance staff had to frequently clear the vegetation manually to increase visitor safety. This project restored the historic Civil War (May 3, 1863) era setting, eliminated a visitor and employee safety hazard, and reestablished native plant species.

Lexington-Ponderosa Mine Reclamation Project - Great Basin National Park

Excerpted from Tod Williams, Great Basin National Park

This project reclaimed 4 inclined shafts, 5 large trenches, 2 pits, and recontoured steep and eroding road cuts and reestablished the natural hydrologic system along a mine access road. This work was a continuation of the assessment and planning on the Lexington-Ponderosa Mine, begun in 1998 using AML funding. In addition, the 1999 work included assessment and planning for future work at the Bonita, Johnson Lake, and Lincoln Mines. ◆

Abandoned Mine Shaft Plug Research Completed

By Philip Cloues, Mining Engineer

A 1999 goal of the Division was to secure a more easily transportable and environmentally friendly polyurethane foam product for backcountry use as a method of plugging dangerous, abandoned mine shafts. NPS has used polyurethane foam over the last 12 years to plug at least 27 dangerous abandoned mine openings in about nine National Park System units. Until 1999 the delivery system for rigid foam required equipment that had to be transported by truck. The system was comprised of a proportioning unit, numerous hoses, a compressor, and the foam product contained in 55-gallon drums. The new system employed the same sturdy, proven foam product, transported to the abandoned mine site in self-contained bags of a size no larger than a backpack. An engineered design change used less foam with a resultant cost savings if strength characteristics could be assured through testing. The Geologic Resources Division set out to achieve this goal through a cooperative low-budget research effort with the Colorado School of Mines and the Bureau of Reclamation.

A six-member team of Colorado School of Mines senior design engineers completed three full-scale compression tests of polyurethane foam mine shaft plugs at the Bureau of Reclamation's Material Engineering & Research Laboratory located in Denver. The one-year project included computer finite element modeling, laboratory bench testing for shear strength, compression strength, and tensile strength. The team presented their findings at the school's Senior Design Trade Fair using a multi-media display. The display included video footage of the testing, Power Point imaging, a poster display of representative graphs, samples of laboratory-tested specimens, and verbal presentations to the various judges evaluating the exhibits.

The design team showed that results using compression transponders vertically placed throughout the foam plug led to a reduction in material cost of 30% at no net loss in load support (30-tons). In addition, the packing boxes in which the foam is initially transported are incorporated into the hollow-core mold-support. This eliminates the cardboard recycling problem in remote park areas. The team plans to post the final report on a website to share this valuable information with other federal and state agencies working to eliminate hazardous abandoned mine shafts in remote areas. The foam used in the research project was donated by Foam Concepts Incorporated, located in Michigan. The effort demonstrates a low budget partnership of industry, academia, and an NPS sister agency working together to find more efficient engineered solutions to problems involving health and safety issues. The engineering report was presented at the National Abandoned Mine Land Association Conference in Steamboat Springs, Colorado in September 2000. Fort Bowie National Historic Site (Arizona) has already demonstrated that the redesigned, "backpackable" foam polyurethane foam product is a useful tool for making safe abandoned mine shafts in NPS backcountry areas with sensitive surface features. ◆

Calling for Stronger Fossil Resource Protection: Geologic Resources Division Contributes to a Report to Congress

By Julia Brunner, Policy and Regulations Specialist, and Lindsay McClelland, Geologist

The U.S. Senate report accompanying the 1999 Department of the Interior Appropriations Act directed the Secretary of the Interior to develop a report assessing the need for a unified federal policy on the collection, storage, and preservation of fossils on federal lands. Congress further directed the Secretary to consider whether current federal policies adequately prevent deterioration and loss of fossils and maximize their availability for scientific study. Eight federal agencies (National Park Service, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Forest Service, and Smithsonian Institution) went to work on the task.

Despite their contrasting missions, the agencies worked closely to develop a report that explains many of the problems and weaknesses of federal fossil management and proposes a long list of practical solutions. They prepared a background paper and conducted a public hearing in June 1999. Building on this public input, the agencies developed a draft report, which was circulated for public review in November 1999. The agencies then analyzed the public comments and developed the final report, which Secretary Babbitt sent to Congress on May 15, 2000.

In his transmittal letter, the Secretary recommended that Congress enact legislation similar to the Archeological Resources Protection Act to strengthen federal fossil management. In the absence of an overarching law, the report advocates improving fossil assessment, management, and protection on Federal lands through the development of a coordinated approach that addresses seven basic principles.

First, the report states that any fossil collection on federal lands for purposes other than science, education, or (at appropriate sites) recreation is incompatible with the public interest. Citing the overwhelming majority of public comments, the report opposes opening federal lands to commercial collection.

Second, the report acknowledges that fossils on federal lands often deteriorate or are lost through theft, vandalism, and other causes, primarily because of lack of personnel and fiscal resources dedicated to their protection. To combat these problems the report advocates increasing the penalties for fossil theft and damage; improving the education of federal land managers, prosecutors, law enforcement personnel, and the judiciary; and increasing the number of field personnel.

Third, noting that paleontological inventories are a vital component of effective management, the report calls for increased emphasis on fossil inventorying, using modern

technology and regional approaches across agency lines. It further advocates the use of modern technology to improve curation and access to fossils by the public and amateur and professional paleontologists alike. Finally, the report emphasizes the need for public involvement in the appreciation and stewardship of fossils.

The National Park Service played a large role in shaping the content of the fossil report. It did so through an effective, interdisciplinary NPS team comprising policy and technical staff from the Geologic Resources Division, several parks, the Ranger Activities Division, and the Museum Management Program. Members of the NPS team participated in all of the agencies' meetings, developed two rough drafts of the report, researched applicable law, contributed significantly to several sections of the final report, and drafted the report's executive summary and Secretary Babbitt's transmittal letter.

Although it is not yet known how Congress will react to the final report, the fact that the November 1999 draft received an overwhelmingly positive response from the public suggests that the National Park Service's time and effort in this project were well spent. The report can be viewed on-line at <http://www.doi.gov/fossil> ◆

Mutual Benefits: Division Co-sponsors Geologic Symposium in Death Valley National Park

Responding to requests from both Death Valley National Park and the U.S. Geologic Survey, the Division co-sponsored a symposium at the park titled "Status of Research and Mapping in Death Valley National Park." Over 110 geoscientists from academia, the NPS, the USGS, the DOE, and BLM, attended. Significant interchange occurred among researchers regarding on-going projects with a strong emphasis on recent tectonic actions in Death Valley. Twelve keynote speakers introduced sessions on regional structure and tectonic, bedrock geology, basin stratigraphy and geophysics, hydrology, geomorphology, and active tectonics. A total of fifty posters supported each of these topics. The USGS has produced Open File Report 99-153, the Proceedings of Conference on Status of Geologic Research and Mapping in Death Valley National Park, which contains the abstracts for all sixty two talks and posters. The Division has some copies still available. Contact Bruce Heise for more information.

Paleontological Resources Management

By Vince Santucci, Park Ranger/Paleontologist

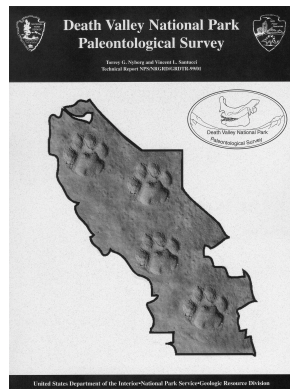
The Division's Servicewide paleontology program grew rapidly during 1999 and 2000. The number of parks requesting assistance with paleontological resource projects increased threefold over 1998. Twenty-six parks previously not on the list were added to the list of Park Service areas managing paleontological resources. The Division's efforts led to increased attention to paleontological resources through the establishment of a new Servicewide GPRA goal tailored to these resources for the agency. The Division produced a number of important Park Service paleontology publications through the Division Technical Report Series. The Division also assisted the Bureau of Reclamation with paleontological inventories at two reservoirs in Utah. The Division partnered with the NPS Ranger Activities Division to assess paleontological resource loss in the parks and to provide fossil protection training to rangers throughout the agency. The Division's Geologist-in-Parks Program recruited an outstanding team of fifteen paleontology interns. Finally, the Division assured the NPS concerns were reflected in a Report to Congress on Federal Fossil Policy (see related article on previous page).

Park Paleontological Resource Inventories

Efforts by the Division's paleontologist and Geologist-in-Park paleontology interns expanded the list of parks that contain noteworthy fossil resources by twenty-six, bringing the Servicewide total to 146 parks. The 26 parks identified and added during the past two years are as follows:

Alibates Flint Quarries National Monument, Biscayne National Park, Blue Ridge Parkway, Cape Hatteras National Seashore, Effigy Mounds National Monument, El Malpais National Monument, Everglades National Park, Gateway National Recreation Area, George Washington Birthplace National Monument, Golden Spike National Historic Site, Harper's Ferry National Historical Park, Hovenweep National Monument, Jefferson National Expansion Memorial, Lassen Volcanic National Park, John Muir National Historic Site, Manassas National Battlefield Park, Missouri National Recreational River, Navajo National Monument, Pictured Rocks National Lakeshore, Pinnacles National Monument, Pu'uhonua o Honaunau National Historic Park, Prince William Forest Park, San Juan National Historic Site, Shenandoah National Park, Virgin Islands National Park, and War in the Pacific National Historical Park.

A paleontological survey for Death Valley National Park was completed and published in 1999. This comprehensive inventory assessed the paleontological resources in the three



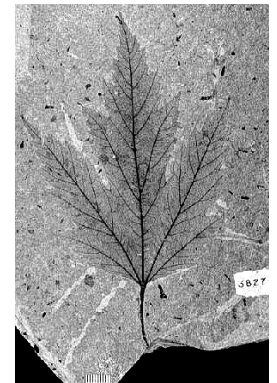
million-acre park. The report, designed as a management document, addresses the interpretation, protection, resource management, and scientific value of the park's fossil record. The inventory resulted in the development of a new stratigraphic column for the park. The report also provides an extensive bibliography of paleontological literature, the production of a GIS paleontological locality map, and the establishment of a series of recommendations for future paleontology projects at the park.

The comprehensive paleontological resource surveys completed at Death Valley, coupled with the one previously completed at Yellowstone has generated considerable interest throughout the Park Service for similar surveys at other parks. During the past two years, comprehensive paleontological resource surveys were initiated at Arches National Park, Big Bend National Park, Bighorn Canyon National Recreation Area, Grand Teton National Park, Joshua Tree National Park, Lake Meredith National Recreation Area, Santa Monica Mountains National Recreation Area, Walnut Canyon National Monument, Zion National Park, and many of the parks in the Alaska Region.

The Park Service in 2000, developed an Oil and Gas Management Plan/Environmental Impact Statement (EIS) for Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument. This planning effort resulted in paleontological resource inventories at both parks, generating a paleontological resource sensitivity map. The Plan established standard operating procedures for locating and protecting paleontological resources.

Thematic Paleontological Resource Inventories

The Division initiated a number of thematic paleontological resource inventories in 1999 and 2000. A Servicewide inventory of paleobotanical resources, including fossilized leaves, flowers, seeds, pollen, and petrified wood, identified fossil plants in 44 NPS areas. The Division began an inventory of National Natural Landmarks (NNLs) and National Historic Landmarks (NHLs) that were established because of significant paleontological resources or because they have known occurrences of fossils.



During 1999, the Geologic Resource Inventory (GRI) Utah Project included an assessment of paleontological resources for each of the parks. The Division paleontologist participated in most of the scoping sessions conducted in Utah. The Utah Geological Association published a manuscript entitled "A Survey of the Paleontological Resources from the National Parks and Monuments in Utah," included in the Millennium Guidebook. The Division began a similar assessment of paleontological resources in Colorado parks in 2000, which should be completed during 2001.

Servicewide GPRA Goal for Paleontology

The NPS adopted a new Servicewide goal for paleontology in 1999. The Division assembled a team comprised of a superintendent and park geologists and paleontologists to develop the technical guidance for the goal. The long-term GPRA Goal Ia9A states that 20% of known paleontological localities in parks are in good condition. The baseline for the goal comprises the number of known localities identified in the year 2000. The team developed draft goal definitions, performance indicators, units of measure, and other factors which were approved by the NPS WASO office of Strategic Planning.

Paleontological Resource Protection Initiatives

During 1999 and 2000, over 300 NPS rangers attended Paleontological Resources Protection training as part of their annual 40 hour law enforcement refresher. The training provided an overview of the methods and strategies employed in the parks to counter the increasing incidence of paleontological resource theft and vandalism. Rangers in parks from the Colorado Plateau, California Desert, Great Plains, and Alaska attended the training.



Rangers attending the Paleontological Resources Protection training in Utah.

The Division partnered with the NPS Ranger Activities Division to conduct a Servicewide survey assessing documented cases of geologic, paleontologic, and cave resource theft and vandalism. The survey revealed the following results: 24 parks reported cases of geologic resource loss, 15 parks reported cases involving paleontological resources, and 17 parks reported cases involving the loss of cave resources. We compared the paleontological resource data to a similar survey conducted in 1992 that focused only on fossils. The data showed a greater than 150% increase in the number of citations issued for fossil theft between 1992 and 1999.



Dinosaur bone in the Morrison Formation showing clear evidence of vandalism - tool and chisel marks on the upper left portion.

Geologists-in-the-Parks Program

The Division recruited 15 paleontology interns to work with the staff paleontologist during 1999 and 2000 (see separate GIP article). They worked on in a wide range of projects including interpretation, curation, preparation, and field collection. Interns were involved in specific paleontological resource projects at Arches National Park, Big Bend National Park, Bighorn Canyon National Recreation Area, Death Valley National Park, Grand Teton National Park, and Zion National Park. Other interns worked on additional projects including paleontological resource monitoring, fossil track replication, development of an NPS paleontology education game, and creation of a new award winning web site for Fossil Butte National Monument.

Many of the interns attended and delivered presentations at the Society of Vertebrate Paleontology meeting in Denver. Intern Paul Kester attended the Paleobotanical Society Meeting in St. Louis. The interns participated in numerous paleontology field trips and four of the interns coauthored publications based on NPS paleontological research. The interns received diverse educational experiences enhancing their understanding of paleontology and of the NPS. We hope to see many of them back as career NPS employees in the future.

Partnerships for Paleontology

During 2000, the Bureau of Reclamation (BOR) contracted the Division to conduct comprehensive paleontological resource inventories at Red Fleet and Steinaker state parks in Utah. The Division completed field inventories for both parks during the summer of 2000 and published the Red Fleet Paleontological Survey report in the fall. The Division and the NPS Harpers Ferry Center provided technical support to the BOR at Fort Peck Reservoir in Montana related to interpretive planning for a new visitor center with paleontological exhibits.

The Division paleontologist provided technical assistance to the United States Forest Service at Flaming Gorge National Recreation area, Wyoming, assessing a newly discovered fossil track site in the Eocene Green River Formation along the lake margin.

Brigham Young University (BYU) donated the Green River Formation paleobotany collection to Fossil Butte National Monument in April 2000. This important research collection includes hundreds of fossil plants collected over the past 25 years by BYU paleobotanist, Dr. Don Tidwell. Although fossil plants from the Eocene Green River Formation lake deposits exhibit extraordinary preservation, the flora has not been well studied. The monument's paleobotany collection now consists of hundreds of individual fossil plants, including a few rare flowers, and contains a number of new species that have not yet been studied and named. A number of researchers have expressed interest in studying this important collection of Green River flora.

Alaska - A New Frontier for NPS Paleontology



In 1999, after years of discussion and planning, the NPS took the first steps towards beginning paleontological resource inventories in the Alaskan national parks. Previous paleontological field work and fossil collections in the Alaska parks have been very limited. The expansive geographic areas and limited access to the parks in Alaska present considerable challenges in planning field inventories. The great potential for discovery has been the driving force for a small team of professional paleontologists and NPS staff who joined forces to take on this ambitious task.

During 1999 and 2000, a small team of paleontologists visited a number of the Alaskan parks to meet with staff and gather baseline paleontological resource data. Park records confirmed that there is little formal documentation available regarding each park's paleontological resources. Interviews with park staff revealed that there were many undocumented fossil localities within parks. Park staff expressed their desire to have access to better paleontological resource information to support the management and protection of these non-renewable resources. During the summer of 2000, Park Service paleontologists conducted reconnaissance surveys at Aniakchak National Monument and Preserve, Denali National Park and Preserve, Katmai National Park and Preserve, Lake Clark National Park and Preserve, and Yukon-Charley Rivers National Preserve.

Paleontology Publications and Education

The Division staff produced several new publications related to NPS paleontological resources. The Division published the Fourth National Park Service Paleontological Research Volume as a Geologic Resources Division Technical Report. This volume contains twenty original peer reviewed articles representing twelve NPS areas. The Division continued to publish the quarterly newsletter, *Park Paleontology*, and posted it on the Division's Paleontology Web Page. The newsletter includes information related to fossil interpretation, protection, resource management, new discoveries, and current issues in paleontology. ◆

The Cave and Karst Program

By Ronal Kerbo, Cave Specialist

During 1999/2000 the Servicewide cave program focused on the following programmatic components:

- ▶ Servicewide small cave assessment projects
- ▶ Technical assistance requests for cave resources management
- ▶ Attendance at cave/karst professional meetings
- ▶ Agency and federal-wide meetings on cave/karst issues
- ▶ Lectures and programs on Servicewide cave/karst issues
- ▶ The National Cave and Karst Research Institute

Highlights of 1999 -2000

The Geologic Resources Division hosted the first steering committee meeting for the start-up of the National Cave and Karst Research Institute (NCKRI). The following individuals attended the meeting: Rod Horrocks, Joel Despain, Mike Wiles, Dale Pate, Larry Norris, Ron Kerbo, all NPS; Jim Goodbar, (Bureau of Land Management), Jerry Trout (U.S. Forest Service), and Bob Currie (U.S. Fish and Wildlife

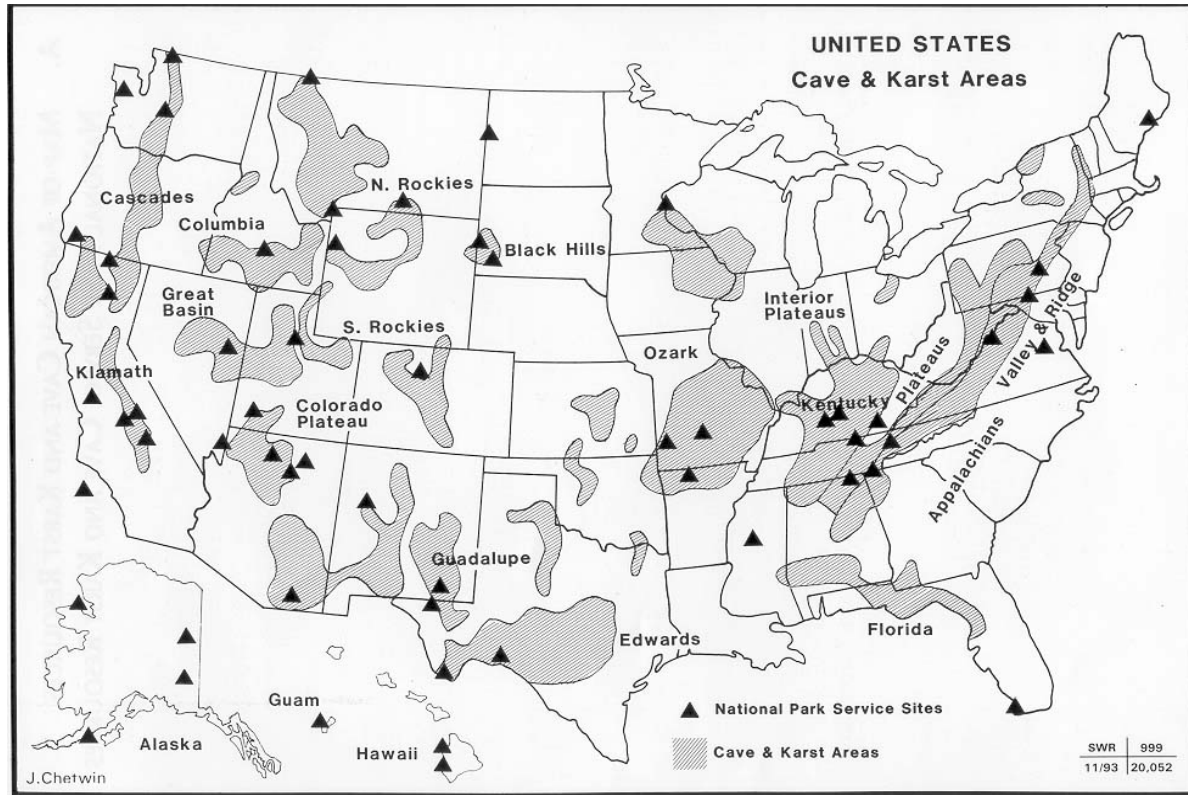


National Cave and Karst Research Institute steering committee meeting in Denver, CO.

Service). The Division provided the steering committee chairperson for the fiscal year for start-up of the Institute. Among several tasks performed by the Institute Steering Committee were: the refinement of the stated mission, goals, and objectives of the Institute; the development of a position description for the Institute director; preparation of a plan that identifies alternatives for the structure of the Institute; and, assistance in the selection of an interim director.

Dale Pate, cave specialist at Carlsbad Caverns, was the subject of an interview in the July 1999 edition of the National Speleological Society News. Dale, a fellow of the Society, came to Carlsbad in July 1991 from the United States Geological Survey. He is respected in the speleological world for his work in the caves of Mexico and his work as the former editor of the "Texas Caver." In addition to his duties overseeing the exploration, survey and science projects in Lechuguilla Cave, Dale is currently the editor of *Inside Earth*, the newsletter of the NPS cave/karst program.

Thirteen cave resource specialists from 7 national parks met



National Park Service Cave and Karst Areas

on July 14 at the National Speleological Society Convention in Filer, Idaho. Kerbo led discussions, bringing everyone up to date on the National Cave and Karst Research Institute. The national cave coordinators for the Bureau of Land Management, Forest Service and Fish and Wildlife Service met in an open forum session with the membership-at-large of the National Speleological Society. Questions for the NPS from the Society members focussed on the Institute, the Federal Cave Resources Protection Act, and concerns regarding the science programs at individual Park Service areas.

The deputy director of the Western Kentucky University Center for Cave and Karst studies, Dr. Chris Groves, met with Division staff to discuss a program for the continuing education of NPS cave and karst specialists. Dr Groves outlined a program to assist Park Service employees to obtain a Master's degree with emphasis on cave and karst studies. We hope to develop a program with Western Kentucky that will strengthen the scientific approach to cave and karst resources management and tie into the future of the National Cave and Karst Research Institute. At this time two NPS employees are pursuing degrees through this program.

Division staff consulted with the United States Forest Service, Tonto National Forest, in Arizona, and reviewed an action plan to set priorities for research and employee safety needs for a new cave discovered during highway construction. The new cave falls within the Federal Cave Resources Protection Act criteria of significance. The plan recommended that employees doing the initial cave survey be connected to the surface by safety lines because of the high potential for CO₂

in the cave. This procedure was determined unsafe and was modified to require the surveyors to wear a self-contained breathing apparatus if air sampling revealed the CO₂ level in the cave was high enough to pose a threat human health.

During three trips to Timpanogos Cave National Monument, the Division provided cave and karst training for the interpretive staff. Discussions included cavern development; speleothem deposition; and, cave conservation, protection, and interpretation. A trip was taken into an off-trail section of the cave where Monument staff will offer an introduction to caving tour. This section of the cave has no constructed trail, so we recommended methods to provide for visitor safety and conservation of the cave resources.

Cave assessment and protection projects and a workshop were funded for Sequoia and Kings Canyon National Park, Chickamauga and Chattanooga National Military Park, Grand Canyon National Park, Natchez Trace Parkway, and Pinnacles National Monument. The projects include cartographic surveys, inventories of cave minerals, geologic mapping and photographic documentation. At Natchez Trace the project includes construction of a gate on the cave entrance to protect an endangered bat species. The Chickamauga project also includes data collection that will help resolve the three-year closure of the caves due to a diesel spill from a pipeline in 1996.

In October 1999, Chattanooga, Tennessee was the location of the 14th National Cave and Karst Management Symposium, hosted by the Southeastern Cave Conservancy, Inc. The theme of the Symposium was "Living with Caves and Karst."

The Symposium drew cave and karst managers, researchers, and cavers from all over the United States including Alaska and international guests from as far away as Australia. Presentations focused on water resource issues, history, education, GIS, cave and karst management and research. The National Park Service has been a primary sponsor of the Symposium since its inception in Albuquerque, New Mexico in 1975. A Park Service representative also sits on the National Cave Management Symposium Steering Committee. Past Symposia have been held at Mammoth Cave National Park, Carlsbad Caverns National Park, and Wind Cave National Park. Ronal Kerbo gave the keynote address.

The Division supported a cave and karst management workshop at Mammoth Cave National Park. The meeting was well attended by both staff from NPS units with cave and karst resources, and by local private cave operators. Ron Kerbo discussed the current status and future of the Cave and Karst Research Institute, summarized the evolution of the Servicewide cave and karst program, and reported on an NPS Cave and Karst Handbook, revisions to NPS Management Policies and NPS 77. Another research management topic covered was bioprospecting in NPS caves, which was covered by Lindsay McClelland. Bioprospecting has far reaching fiscal effects, and collecting permits must address this issue.

The Division worked with Chuck Barat of Lava Beds National Monument to assure the suitability of a site selected for a new visitor center. The staff of Lava Beds has made a great effort to protect the natural resources of Lava Beds. To be acceptable, it was recommended that the visitor center not overlay any known cave passages, that known cave passages are at least 200 feet away; and, it would allow for the inclusion of mitigation devices for parking lot runoff. The park enlisted the services of a geophysical contractor to survey the site, using magnetometry to identify small underground anomalies that might represent very minor voids on the periphery of the proposed site. The voids, if indeed there, are not close enough to the majority of the work site to present a threat to the natural resources. The park is to be commended for initiating the survey and for locating a site that represents the most resource-friendly location for the new visitor center, within the confines of other parameters of the project.

At the request of Mojave National Preserve geologist Ted Weasma, Joel Despain and Ron Kerbo visited the Preserve to discuss developing a cave management program. A site visit was made to the Cima Lava Tube area. The result of this visit was an action plan for the protection and conservation of Cima Lava Tube. As a follow up, we provided guidance to Preserve staff to produce a general cave management plan.

The Division assisted the Bureau of Land Management in designing a cave and karst management training module at the Bureau National Training Center in Phoenix, Arizona. The training module will be presented in April 2001 in Carlsbad, New Mexico. The training agenda and lesson plans are complete and the Park Service will be given slots for NPS staff to attend the training.



Delicate soda straw stalactites in Carlsbad Caverns National Park, NM.

At the request of Mr. Kenneth E. Travous, Executive Director of Arizona State Parks, Ron Kerbo conducted a site visit and provided technical assistance on cave management issues at Kartchner Caverns State Park. The primary concerns were the protection of the cave, recommendations for scientific advisors on the microclimate of the cave, and review of environmental data collected from monitoring stations in the cave. Kerbo's report to Arizona State Parks has resulted in several changes to the management and protection of Kartchner Caverns.

The book *Deep Secrets-The Discovery and Exploration of Lechuguilla Cave* chronicles the exploration of Lechuguilla Cave at Carlsbad Caverns National Park. The book is coauthored by four of the caves original explorers and covers the period of exploration from the 1986 "breakthrough" to 1993, when the cave was discovered to be the deepest cave in the U.S. The book is highly charged with the personalities and the "speleo-politics" that surround major cave exploration efforts. The roles of NPS cave specialists and NPS policies in the efforts to explore this world class cave are also covered in the new book. The authors have taken an unblinking look at the danger, adventure and ultimate rewards of the efforts to push further and further beneath the New Mexico desert and have created a caving book that will become a classic adventure tale. ◆

Geology Strategic Planning Goals

By Bob Higgins, Chief, Science and Technical Services Branch

In 2000, the WASO Office of Strategic Planning revised the NPS Strategic Plan to include geology related GPRA goals. GPRA stands for the "Government Performance and Results Act of 1993." A key aim of this statute is to get agencies to use resources effectively by focusing on "results" not simply level of effort. All the goals in the NPS strategic plan reflect the organization's mission to preserve resources and serve the public. Goals for geology were specifically developed by the Division in cooperation with the Planning Office to elevate attention to geologic resources and to further the acquisition of knowledge about the resources. The three new geology-related GPRA goals focus on the following:

- ▶ Protection of paleontological (fossil) sites and maintenance of those sites.
- ▶ Restoration of cave floors in passageways disturbed by human activity.
- ▶ Identification of geologic processes being influenced by human activities.

In addition, a fourth geology-related goal exists related to the restoration of disturbed lands. The NPS adopted this goal in 1997 and incorporated it in the NPS Strategic Plan at that time. This is an important goal area that continues to be refined.

Paleontological Resources

Goal Statement Ia9, Subgoal A, states that by 2005, "20% of known paleontological localities in parks are in good condition."

The NPS has many nationally and internationally important parks designated specifically for the protection and public enjoyment of their paleontologic (fossil) resources. Well known sites include Dinosaur National Monument, Hagerman Fossil Beds National Monument, Florissant Fossil Beds National Monument, Fossil Butte National Monument, and Petrified Forest National Park. There are over 130 other park units with paleontologic resources. From diatoms to dinosaurs, paleontologic resources are scientifically important and worthy of protection. They provide a window to the past and a means for understanding potential future changes in the world around us. However, very few parks have inventoried or are even aware of these resources in their parks. Inventorying is therefore critical to meeting this goal.

The NPS is making efforts to increase awareness at the park level of the wide variety of known paleontological resources. Fossils are the physical evidence of past life on the earth and include representatives of all kingdoms of life. Secondary evidence of life such as trace fossils (burrows, tracks, etc.) are also part of the fossil record but are often overlooked. A paleontological locality is the physical location of the fossil or trace fossil prior to removal. Information gained from studying the locality and context, such as paleontological

environment, relationships to other species, and type or cause of burial and preservation provide information that may be as important as the fossil itself. Technical guidance for this



More than 130 parks have paleontological resources, but few have information on condition and vulnerabilities.

goal makes it clear that we must maintain all the data from a locality and not just the location and type of fossils collected.

The paleontology GPRA goal is intended to be a catalyst for developing an integrated Servicewide paleontological program. Paleontological inventories contribute information to the broader Geologic Resource Inventory and provide critically needed baseline information. Survey information is used to maintain and protect paleontological site localities. With such information, parks will be able to evaluate their resources and design a site monitoring system to meet specific needs. Additionally, Servicewide programs to increase awareness of fossil resource issues, and train law enforcement personnel in preventing illegal fossil collection, will have better information on resource condition and vulnerabilities.

Cave and Karst Resources

Goal Statement Ia9, Sub goal B, states that by 2005, "72,500 square feet of cave floors in parks is restored."

Over 75 parks contain significant caves and karst features as defined in the Federal Cave Resources Protection Act and implementation regulations. These range from parks with as few as 10 to 15 caves such as Chesapeake and Ohio Canal National Historical Park to Grand Canyon National Park with well over 400 caves. At present, a total of 3600 caves are known to exist in parks. Of these, the NPS gives regular guided tours in 17 caves in 11 parks. These caves are most at risk of damage and are the current focus of the GPRA goal.

Any visitation in caves causes some direct degradation of cave resources. In developed caves, foreign materials resulting from human use, such as lint, algae, and fungi are a problem. To help maintain a natural cave environment, these materials must be routinely removed. Trips into off-trail areas and into undeveloped caves often result in mud buildup on

flowstone areas. Parks will be asked to undertake inventories to assess the extent of impacts to cave floors, and develop priorities for their restoration. The use of trained personnel from the NPS and volunteers from the speleological community is critical to the success of this goal. Parks should also monitor both developed and undeveloped areas and clean these areas periodically.

Other cave restoration activities of a non-routine nature include restoring scars from construction projects. Old trail fills and areas damaged by development will, if possible, be at least partially restored by careful work and research. Care must be taken in establishing trails through any cave. Speleothem breakage is very difficult to restore. Parks should conduct restoration whenever possible, with the understanding that damage represents a measurable resource loss. Parks should also ensure that individuals with appropriate expertise and training are involved in the planning and execution of restoration projects, and that projects are performed to NPS standards as defined in NPS policy and guidance documents. This may require consultation with other authorities, groups, or entities having expertise in cave restoration.

The Division views the adoption of this GPR goal as a very positive step. However, because of its narrow focus on caves open only to the public, it leaves out the vast majority of caves in the National Park System. The Division is working closely with the WASO Strategic Planning Office to modify this goal to encompass the full extent of cave and karst resources in parks and the resource protection challenges they face.



As with moving dunes, many geologic processes and their effects on park resources are easily observed.

Geologic Processes

Goal Statement Ib4, states that by 2005, *"geological processes in 53 parks [20% of 265 parks] are inventoried and human influences that affect those processes are identified."*

Units of the National Park System offer excellent opportunities to observe a host of geologic processes in action. Examples include the down-cutting and erosion which formed the Grand Canyon; eruptions of Hawaii's Kilauea volcano;

wave erosion shaping the shorelines of Cape Cod; the slow movement of glaciers making their way to the sea from the mountains of Wrangell-St. Elias National Park and Preserve; the work of wind, rain, sand and ice to produce the fantastic landscapes of Badlands National Park; or the more subtle, but no less important, development of soils found undisturbed in all of our park units.

Rates of geologic change are key environmental indicators, which collectively with other vital signs, can be used to gauge the function of healthy ecosystems. It is important that geologic processes be allowed to function in a relatively unaltered, natural state in parks to maintain a healthy balance in the ecosystem. This goal is the first step to better understanding of geologic processes at work and of the human influences on those processes in the 87 million acres administered by the NPS.

Restoration of Disturbed Lands

Goal Statement, Ia1, Sub goal B, states that by 2005, *"10.1% of targeted parklands, disturbed by development or agriculture, as of 1999 (22,500 of 222,300 acres) are restored."*

This goal directs the NPS to restore to their natural condition parklands where natural processes have been significantly altered by past land use and agricultural practices. Impacts from land-use practices, including disturbances from grazing, roads, railroads, dams, mines or other abandoned sites, directly affect other natural resources and can result in severe and persistent changes to habitat conditions and ecosystem functions. By restoring these lands, the NPS can help accelerate the recovery of the biological and physical components of the ecosystem including soils, vegetation, and the geomorphic and hydrologic settings.

Restoration is the process of assisting the recovery of disturbed areas and reintegrating the site into the surrounding natural system. Restoration activities may be structural, physical, or chemical in nature. Active management also includes removal of human disturbance(s) that are causing resource degradation or that are preventing natural recovery of a site. For this goal, restoration work includes all actions taken to recover lands disturbed by development or agricultural use, and the effects of such development, to return the site to its pre-development condition and function. The actions may include rehabilitation, reclamation, and mitigation, as long as this work results in the complete removal of the development and its effects.

Formulation of the NPS strategic plan that meets the requirements of GPR is an important step toward fulfilling the mandates of the Organic Act that directs us, among other things, to conserve our resources for future generations. GPR goals serve as a tool by which we measure our progress. The Division is anxious to continue assisting parks in their efforts to meet the various geology-related GPR goals to enhance the sound stewardship of these fundamental resources, which serve as the base to a healthy ecosystem. ◆

Geologic Input to Voyageurs National Park General Management Plan

By Sid Covington, Geologist

The park invited Division staff to meet at Voyageurs to help develop the geologic resources section of the General Management Plan. Understanding the park's geologic resources is critical to the Plan in general and to resource management planning in particular. Also, the Plan will provide the basis for the formulation of future research proposals in the park's resource management plan.

Division staff and management visited Voyageurs June 22- 24, 1999, first meeting with the superintendent and staff of Voyageurs. After the meeting, park staff led field excursions by boat to locations on Rainy Lake, Kabetogama Lake, Namakan Lake, and Sand Point Lake to examine the geology of the area. Lee Grim, park biologist, led the discussions of the geology. Lee later identified each stop on a map of the park. These stops may later be developed as a geologic tour guide for park visitors.

In addition to providing geologic expertise in the development of the geologic section of the Plan, involved staff identified the need for a comprehensive geologic interpretative program. This program may include: (1) developing brochures, pamphlets and informational bulletins on the geology of Voyageurs to be made available at the visitors centers; (2) providing the public with representative geologic literature and possibly a database for further information; and, (3) developing an interpretative boat tour, emphasizing geology, but including related natural and cultural resource information. The tour could be in the form of numbered stops identified and discussed in a brochure, or by developing interpretative plaques or signs at each site.

A second meeting between park staff and the Division took place June 1 and 2, 2000, at the park. This visit was set up to view and discuss the geologic resources of the park, address the status of geologic mapping, and to further assess resource management issues and needs.

The two day trip included a field trip by boat to view the geology of the park as well as a scoping session to present overviews of the Park Service Inventory and Monitoring program, and the ongoing Servicewide Geologic Resources Inventory. Chris Hemstad (University of Minnesota), David Southwick (Minnesota Geological Survey) and Richard Ojakangas (University of Minnesota) led the field trip portion of the park visit. Follow-up round table discussions included the topics of geologic interpretation, the status of geologic mapping, sources of available data, and geologic hazards.

The Division is helping to facilitate the geologic mapping of the park in coordination with the United States Geological

Survey, the Minnesota State Geological Survey and the University of Minnesota-Duluth. Geologic mapping is a portion of a comprehensive mapping program that includes soils and vegetation mapping using a Geographic Information System. The resulting product will aid ecologists in understanding the transitional zone between the three ecological provinces - prairie, boreal forest, and mixed hardwood that are in the immediate area of the park.

Voyageurs National Park consists of interconnected lakes and numerous islands along the boundary between northeast Minnesota and southern Canada. The name is derived from



Finger Bay in Voyageurs National Park, MN. A potential stop for an interpretive boat tour featuring geologic sites.

the route of the French-Canadian voyageurs that traveled by canoe in the fur trade of the late 1700s. The major lakes in the park are Rainy Lake, Kabetogama Lake, Namakan Lake, Sand Point Lake, and Crane Lake. The park is located in the southern portion of the Superior Geologic Province of the Canadian Shield, a vast peneplain of ancient Precambrian rocks that form the core or craton of the North American continent.

The geology consists mostly of Precambrian metamorphic and igneous rocks including schists, gneisses, granites and igneous dikes as old as 2.7 billion years. Superimposed on this is Pleistocene glacial activity (less than 1 million years old) that carved the present morphology of the lakes.

Although geology forms the scenery that typifies Voyageurs, the current General Management Plan speaks very little about geology and geologic processes. The enabling legislation states that the purpose of the Act establishing the park in 1975 ". . . is to preserve for the inspiration and enjoyment of present and future generations, the outstanding scenery, geological conditions, and waterway system . . ." The park provides outstanding opportunities for scientific study, public education and appreciation of the park's setting. However, only limited geologic research has been completed in the park. ◆

Geologic Story of Devils Tower National Monument

By Sid Covington, Geologist

Division staff geologists, Sid Covington and Jim Wood, visited Devils Tower National Monument July 8 - 9, 1999, to evaluate the interpretation of the geology of the Monument. Meeting and discussions with the park superintendent and staff as well as hikes around the tower and vicinity revealed the need for the following:

- Research the literature for information on the geology of Devils Tower
- Prepare a basic interpretive story that accounts for differing theories of the formation of the Tower
- Assist in recruiting well-qualified geology applicants for seasonal interpretive positions
- Assist in providing Geologist-in-the-Park intern for interpretation and resources management
- Provide a list of geologic contacts, including colleges and universities, state surveys, USGS, other NPS contacts, and local geologic organizations
- Provide technical review of interpretive products at the visitors center, wayside exhibits, and site bulletins
- Develop recommendations for interpreting the Red Beds Trail and surrounding geology

The Monument brought in Stephanie Shepard, as a Geologist-in-the-Park to help with geologic interpretation for the summer of 2000. In addition, assistance from the Geological Survey and from Geologic Resources Division, should add to the interpretative program at Devils Tower.

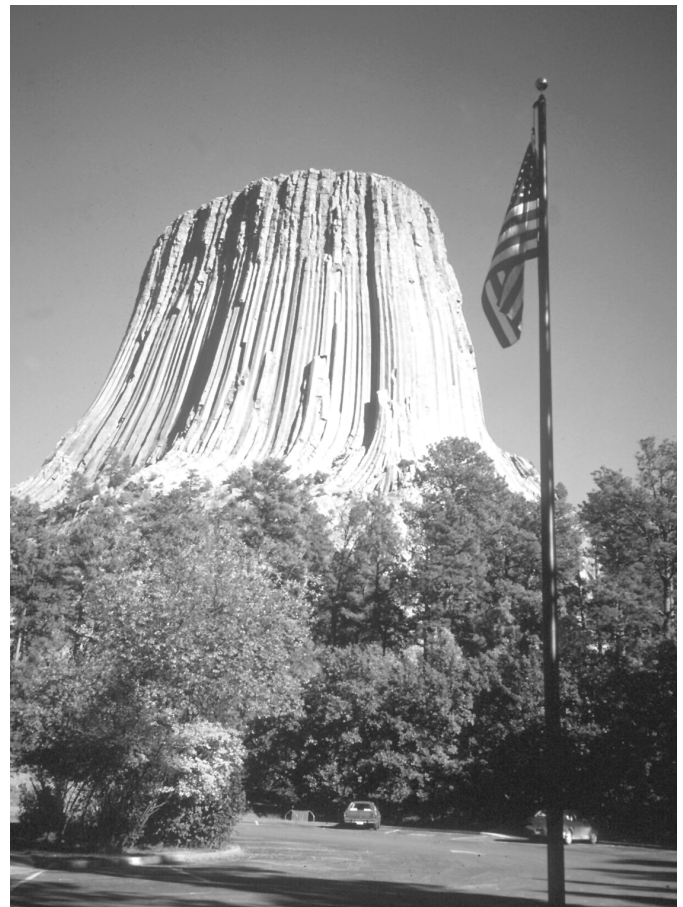
Devils Tower was established in 1906 by President Theodore Roosevelt as America's first national monument. It is located at the western edge of the Black Hills uplift near the Bear Lodge Mountains in northeastern Wyoming. The monument is about 2 square miles in area and lies near the center of Crook County, Wyoming.

The geology exhibits at Devils Tower National Monument display a single interpretation of the geologic story of the Tower - that of a volcanic core or neck. This interpretation can be found in the park's brochure, visitor center displays and video presentation, and on several wayside exhibits throughout the park. Although this interpretation has prevailed for many years, there are other theories for the formation which should be presented to the public. The park would like to present to visitors these alternative theories with the pros and the cons of each.

The Monument has technical reports, papers, and other resources available. However, a more thorough compilation of research materials to help in revising the geologic story would be helpful. GRD can assist the park to develop new wayside exhibits, and new displays in the visitors center, and to revise the park brochures and bulletins. The Tower Trail, which is a 1.3-mile paved trail at the base of the tower, is

where most of the interpretative displays can be found. There is a need to revise several of these plaques to more accurately interpret the possible origins of the Tower.

The Red Beds Trail is 3 miles long, the longest trail in the monument. It take a wider loop around the Tower through the sedimentary red beds which surround the Tower. The Red Beds Trail provides views of the Belle Fourche River valley and the Black Hills to the east. The Division is working with the staff of Devils Tower and with Jack Epstein of the United States Geological Survey to develop the Red Beds Trail into an interpretative tour with wayside displays describing the sedimentary geology and the relationship of these sedimentary beds to the Tower. ◆



Devils Tower National Monument, America's First National Monument, is still working to include multiple geologic theories in their interpretive program.

Geology of Coastal Ecosystems Workshop

By Sid Covington, Geologist

Introduction

The Geology of Coastal Ecosystems Workshop took place in Ocean City, Maryland, and on Assateague Island National Seashore September 8-10, 1999. The workshop was conceived, designed, financed, and hosted through collaboration among the Geological Society of America's Institute for Earth Science and the Environment, the NPS Geologic Resources Division, and the Coastal and Marine Geology Program of



Geologic fieldtrip stop at the inlet between Assateague Island National Seashore and Ocean City, MD.

the U.S. Geological Survey.

About 60 NPS participants came from coastal parks as distant as Alaska and as near as the local host unit at Assateague. About 40 USGS scientists and administrators, from all coastal regions as well as from the Director's Office in Reston, VA, participated. Academic participants came from university programs by special invitation from the Geological Society of America.

Goals and Desired Outcomes

The major goals of the Workshop were to bring together scientists, resource managers, park superintendents, and the academic community to make the connections between scientific research and resource management in National Parks Service units, to make connections between geology and ecosystem management and to make connections between park management and staff and external sources of expertise and knowledge such as the U.S. Geological Survey.

Sixty-six national park units have coastlines. The NPS manages an estimated 7,310 miles of coastline distributed among 10 Alaskan coastal parks, 17 Atlantic parks, eight Gulf Coast and Virgin Islands parks, 19 Pacific parks, and six Hawaiian parks. Common themes emerged despite the diversity among park units: the impact of people on coasts and coastal processes; the need for more and easier access to scientific information; centralized sources of information; and, rapid response to short-term needs for scientific expertise.

The desired outcomes are for geoscientists to understand the needs of resource managers in the parks, and how these

geoscientists can provide research products that are useful to managers. Managers must be made aware of the types of geologic knowledge that can be usefully applied to ecosystem management. Geoscientists and resource managers need to know when, where, why, and how to contact each other to work toward shared goals.

The defining attribute of coastal zones is change, yet we still seek to control coastal processes: to stabilize dunes, to provide quiet waters to protect our dwellings and businesses. When the system becomes less than gentle, when our shoreline developments fragment habitats with loss of desirable species, we want our shorelines "restored" to some previous state that suits our needs and desires. Coastal park managers are required to make trade-offs in a constant balancing act between socioeconomic demands and geo-ecologic realities forcing land and resource managers into a reactive mode. The better science understands "what if," and the better that understanding is articulated to decision makers and problem solvers, the better able they will be to deal with "what now."

The Workshop is evidence that coastal parks feel the need and have the desire to manage proactively. A proactive management paradigm requires a more thorough and comprehensive scientific basis for decision-making than a reactive paradigm, as well as public acceptance of managing for change rather than stasis. Workshop organizers and participants feel that we progressed toward articulating both the need for and the opportunities for research in coastal NPS units. It is up to the scientific community to hear the need and to respond.

The Workshop Process

The Workshop began with a plenary session with an overview of coastal issues followed by examples of specific resource management issues by geographic region. The plenary session was then divided into breakout sessions representing each geographic region, North Atlantic (and lakeshore), South Atlantic, Gulf of Mexico, Pacific and Alaska. The breakout sessions were to identify common research and information needs. The Workshop participants worked in small groups (20-25) to identify needs common to coastal parks in each region. These formed the basis for formulating cooperative research planning. A second plenary session consisted of

reports from each of the breakout sessions followed by discussions on the issues.

One day was set aside for a field trip to Assateague Island to study in the field coastal processes and issues. The field trip was followed by another plenary session for the keynote speaker to refocus the groups and set the stage for another round of breakout sessions. This final breakout was to address five basic issues: (1) long-term research needs of coastal parks; (2) short-term needs for technical expertise in coastal parks; (3) information transfer; (4) connecting to strategic plans, General Management Plans, and Resource Management Plans; and, (5) setting priorities.

Major Themes

There were three recurrent themes that were brought out in the Workshop discussion groups:

1. NPS research needs

- Coastal baseline inventory and monitoring information
- Expanded geologic and biologic mapping, including the mapping of geologic hazards
- Development of shoreline models that predict future trends and changes
- Geologic research in coastal parks, both short term (one season or less) and long term
- Research on impact of increased coastal development and use on coastal parks

2. NPS/USGS/GSA Interagency information transfer and communications

- Improved interagency communications, including outreach, networking, and partnerships
- Expanded information transfer and education, especially from geoscientists to park staff and to park managers

3. NPS/USGS/GSA Interagency program planning and development

- Develop increased scientific input into Park Service planning, including long-range strategic planning, administrative planning such as General Management Plans, and Resource (coastal) Management Plans
- Set national and regional research priorities for multiple parks that consider USGS plans and capabilities
- Identify both existing and new funding sources for coastal geologic research in DOI

Action Items

The Workshop resulted in seven action items for both the Park Service and the Geological Survey:

1. Within a year, establish, fund and convene a long term advisory group of 10-20 coastal research scientists and park managers from NPS, USGS and academia to provide oversight and review of inventory and monitoring and research recommendations for the National Park Service. Identify a person from both USGS and NPS with responsibility to

facilitate and improve cooperation at the national level. Funding should be \$250,000/year starting in 2001.

2. Within two years, the Advisory group should develop a multidisciplinary and multi-agency strategic plan of inventory and monitoring programs using standard protocols and standard program templates specific to each park, building on the templates developed at Cape Cod National Seashore, at Channel Islands National Seashore and at other parks. These would be modified as needed and revised by the advisory group.

3. The Advisory group should develop an assessment of research needs in the coastal parks based upon: (a) The Fact Sheets from coastal parks prepared for the workshop; (b) Park Resource Management Plans; (c) Investigator's Annual Reports, and, d) USGS strategic and science planning documents.

4. USGS and NPS managers should expand geologic and biologic mapping to include coastal and nearshore NPS environments as the fundamental coastal inventory and monitoring database needed to understand ecosystem change. Goals call for completing initial NPS coastal mapping and inventory by 2015.

5. USGS and NPS program managers should develop a joint DOI funding initiative for approximately \$5,000,000 annual base funding increase for : (a) the NPS Natural Resource Challenge Program, or (b) the Inventory and Monitoring Program, or (c) the NPS-USGS Coop Projects section of the USGS budget and, (d) the USGS Coastal and Marine Program for use in FY-2002 and beyond.

6. USGS and NPS managers should establish approximately 10 appropriate and unique NPS sites as national standards for monitoring of coastal ecosystem change and restoration success as a basis for long range (100 yr) NPS planning that considers the impacts of global warming, and sea level rise. Agencies should fund associated monitoring and research efforts. Funding requirements are estimated at \$100,000 per site per year.

7. Detail a USGS coastal expert to a coastal park for three to six months to work with the resource management staff.

The report was completed and distributed electronically in March 2000. Subsequently, bound, hard copies were made and distributed to interested parties. The report provides an Executive Summary and the seven action items given above. Included in the report are summaries of the five regional breakout sessions, the keynote addresses, field trip information, and a list of NPS and USGS contacts for the coastal parks. ◆

Ge indicators: A Tool for Understanding Ecosystem Change

By Bob Higgins, Chief, Science and Technical Services Branch

The NPS is changing the way it views and manages geologic resources. Increasingly, park managers are integrating geologic resource information and considerations into the broader context of park management. In 2000 the Division introduced ge indicators to NPS resource management as a new ecosystem management tool for assessing rapid changes in the natural environment. Ge indicators are measures (magnitudes, frequencies, rates, trends) of physical processes on the earth's surface that may undergo significant change in less than 100 years and may be affected by human actions. They were developed by the International Union of Geological Sciences.



During ge indicator workshops participants share geologic and historic expertise to better understand human influences on rates of geologic processes.

Ge indicators provide a checklist that enables parks to identify geologic and hydrologic processes that help evaluate the state of the environment, ecosystems change, and how humans are affecting natural systems. The easy to use checklist includes twenty-seven indicators selected for ecological importance. Some are single parameters, such as shoreline position, and others are aggregates of several measures, such as groundwater quality. Examples include dune formation, groundwater level, karst activity, soil and sediment erosion, and wetland extent, structure and hydrology. The tool provides separate criteria for each ge indicator so the user can determine the importance of the indicator for specific natural systems.

The ge indicators help answer NPS resource management questions about what is happening to the environment, why it is happening, and whether it is significant. They also establish baseline conditions and trends so that human-induced changes can be identified. In 2000, ge indicators were successfully integrated into several NPS projects to provide science-based information for resource management. Additional information about ge indicators can be found at:

<http://www2.nature.nps.gov/grd/geology/monitoring>

Long-term Monitoring and Vital Signs

Parks need a clear and simple method to identify the health of geologic resources. Geologic monitoring can be used to detect long-term environmental changes, provide insights into the ecological consequences of those changes, and help determine if observed changes dictate a corrective action in management practices. Geologic indicators can be used to assess whether environmental change is within a normal or anticipated range of variation. The preservation of healthy parks depends on acquiring timely and accurate information about the condition of the natural resources, monitoring how conditions change over time and acting on that information with confidence. Achievement of this goal will provide a sound scientific foundation for measuring NPS performance in natural resource stewardship.

Geological indicators of rapid ecosystem change are being integrated into the NPS Vital Signs Monitoring Program as a method of assessing "vital signs" of ecosystem conditions in 32 monitoring networks and individual park units.

Through fact-finding workshops, parks or groups of parks identify vital signs. The workshops involve park staff and experts from inside and outside the NPS who are knowledgeable about natural resources and ecosystems. In April 2000, the concept was introduced at the Northeast Barrier Network Vital Signs Scoping Meeting. The participants used a checklist of geological indicators and criteria for measuring magnitude, frequency and rates of change to evaluate options for monitoring. A working subgroup selected shoreline position as a critical ecological indicator. The next step is for the affected parks to design and implement monitoring programs in accordance with the established indicators and criteria.

The Division also invited geologists to participate in the Southeast Region and Craters of the Moon National Monument vital signs workshops. The lack of park and regional geologists makes it necessary for the Division to have its staff participate in these workshops or broker the services of non-



Geologic clues on the landscape help parks to understand changes in the ecosystem. Fieldtrip to Lassen Volcanic National Park, CA.

NPS geologists to fulfill this obligation to the vital signs program. The Division is providing geologic assistance to parks and monitoring networks to identify geologic processes critical to healthy ecosystems in parks in keeping with the implementation strategy for the vital signs monitoring program.

In August 2000, the NPS long-term monitoring program initiated work on a guidance handbook for Natural Resource Monitoring. The Division drafted a geologic resource monitoring chapter for this handbook, utilizing the geoindicators concept. This draft monitoring guide can be found at: http://www2.nature.nps.gov/grd/geology/monitoring/geomonitoring_guidance.pdf ◆

National Cave and Karst Research Institute

By Zelda Chapman Bailey, Interim Director

Congress mandated the establishment of the National Cave and Karst Research Institute in October 1998 (16 U.S.C. §4310, note) under the direction of the National Park Service. The Act stipulated that the Institute be located in the vicinity of Carlsbad Caverns National Park in New Mexico (but not inside park boundaries). The Institute cannot independently spend Federal funds without a match of non-Federal funds.

Mission and Goals

The mission of the Institute is to:

Further the science of speleology by facilitating research, enhancing public education, and promoting environmentally sound cave and karst management.

The goals of the Institute are set forth below and are derived from the text of the 1998 Act:

- ▶ Further the science of speleology through coordination and facilitation of research
- ▶ Provide a point-of-contact for dealing with cave and karst issues by providing analysis and synthesis of speleological information and serving as a repository of information
- ▶ Foster partnerships and cooperation in cave and karst research, education, and management programs
- ▶ Promote and conduct cave and karst educational programs
- ▶ Promote national and international cooperation in protecting the environment for the benefit of caves and karst landforms and systems
- ▶ Develop and promote environmentally sound and sustainable cave and karst management practices, and provide information for applying these practices

Timeline for Full Implementation

The Interim Director for the Institute, Zelda Bailey, reported in July 2000, for a two-year period to move forward with NPS efforts to establish the Institute. Key duties include defining the purview and scope of operation, designing an organizational structure, forming partnerships, finding funding sources and a physical facility, and defining research needs. The Institute will pass through several phases before it fully reaches the capacity to sponsor a wide range of activities.

The Interim phase will span about three years, August 1999 to August 2002. This phase began when a Steering Committee convened to articulate expectations for the Institute and to draft specifications for recruitment of an Interim Director, and will end when the Interim Director completes the initializing tasks.

The Gearing Up phase will likely take one additional year (2003), and will consist of staff recruitment, moving into a building (possibly a temporary facility), initial operational setup, and the transition from the Interim Director to the Director. If funding and the ability to operate allow, research

grants could be distributed during this phase and the real work of the Institute initiated.

The Basic Institute phase will take another one to two years (2004-05) while the experience of the staff and the capacity of the Institute gradually increase, and financial resources for full operation accumulate. If a building is constructed, it may be completed during this phase. A grant process will be operational, and results of research supported by the earliest grants may become available.

The Fully Operational phase will occur by 2006, when the Institute becomes a significant and recognized resource in cave and karst research, education, and support of cave and karst management.

Current Status

A Federal Working Group assists the Interim Director in developing the operating plan for the Institute. The Group members are Ron Kerbo, Dale Pate, Larry Norris, David Ek, and Lindsay McClelland, National Park Service; Tom O'Shea and Randy Orndorff, U.S. Geological Survey; Jim Goodbar, Bureau of Land Management; Bob Currie, Fish and Wildlife Service; and Jerry Trout, U.S. Forest Service. In addition to their agency affiliations, each person in the Group has responsibility to represent and communicate with non-Federal constituency groups.



*NCKRI Interim Director,
Zelda Chapman Bailey.*

The Institute and New Mexico State University, which has a campus in Carlsbad, signed a partnership agreement that gives the Institute a small amount of office space and administrative support during the Interim and Gearing Up phases.

Although the Institute, New Mexico Tech, and the City of Carlsbad, have signed no formal agreement, several meetings were conducted to lay the groundwork for long-term partnerships. The city and New Mexico Tech are petitioning the New Mexico legislature for funds to construct a building for the Institute. A cooperative agreement for building space could provide the required match to Federal funding for basic Institute operations.

The Institute is working with the NPS Mexico Affairs Office to form partnerships and collaborative activities with Mexico related to cave and karst resources. The NPS Mexico Affairs Office is making plans to meet with Mexico representatives. Similar activities will be initiated with Canada through existing agreements.

Although the Institute is not yet organized or fully functional, several collaborative projects are already being planned with other agencies and cave and karst organizations during the Interim phase. These projects will provide name recognition

and important products sponsored by the Institute.

The institute is compiling ideas for research needs through discussions with a wide variety of interest groups, scientists, and resource managers. As the list grows, groupings of research areas should emerge that would form the basis for articulating national research needs. Focus groups are being convened at professional meetings to provide a wider forum for input into the research needs. Through this process the Institute can provide a national scope and overarching goals to cave and karst research. ◆

Volcanism in National Parks Workshop

By Lindsay McClelland, Geologist

More than 75 scientists, educators, managers, and public officials met September 26-29, 2000, in Redding, CA, near Lassen Volcanic National Park, to address research, management, and interpretation of volcanic features in national parks. Jointly sponsored by the NPS and the U.S. Geological Survey (USGS), the workshop sought to improve scientific input to park management, and to facilitate research and hazard monitoring in parks where volcanic features and hazards are significant aspects of the landscape and the visitor experience. Presentations and focused discussions illuminated issues affecting volcanic parks, and then defined specific action items that would help parks respond effectively to those issues. Cooperative work by the NPS and USGS to address key action items will continue in 2001. The two agencies will distribute a report addressing priorities identified by the workshop.

Workshop participants emphasized that to be useful, scientific information must be interpreted for park managers, linked to specific park issues, and integrated into guidance for park staff. Because there are few geologists on park staffs, the responsibility for providing useful geologic information to management often falls directly upon the scientists performing geologic research. Volcanologists and other geologists responsible for monitoring and forecasting natural hazards have pioneered successful approaches to convey the scope and degree of risk to managers and the general public, and are applying these techniques in and around parks.

It is important to recognize that, in parks in active geologic areas, it may be impossible to avoid placing public facilities in areas of significant geologic risk. As stated in Chapters 8 and 9 of the 2001 NPS Management Policies, a park's decision to operate visitor facilities in areas of potential geologic hazards is a matter of individual park manager discretion. But, parks should strive to avoid siting facilities in such areas, and should also strive to relocate damaged or destroyed facilities to areas believed to be free from natural hazards. It may also be advisable for parks to clearly inform park visitors about those hazards and the risks involved."

At the workshop the participants also recognized the need for new, more effective geologic interpretive products. However, few park interpreters have backgrounds in geology or feel confident in communicating geologic information to the public. The challenge to scientists and interpreters at the workshop was to work cooperatively to deepen public understanding of volcanic processes, and to build on the experience of volcanologists in explaining hazard information to government officials, community groups, and the media. NPS interpretation plays a significant role in geologic hazard awareness programs, and offers the opportunity for scientists to convey the significance of their work to the public. Websites provide an important new interpretive opportunity with the potential for links to sites with an enormous amount of information. Still, we do not know the depth of understand-

ing that many viewers have after reading the information available to them on the Internet. As the potential of the Internet grows, a wide range of both traditional and innovative interpretive products continues to increase. ◆

Restless Volcanoes Define Parks

Volcanoes are the fundamental components of a number of parks, driving key ecosystem processes and representing hazards to visitors, staff, infrastructure, and surrounding communities.

- ▶ Alaska national parks with volcanoes include: Katmai National Park and Preserve, site of the largest eruption of the 20th century; Aniakchak National Monument and Preserve with 50 eruptions since a caldera 10 km in diameter formed 3,000 years ago; Wrangell-St.Elias National Park and Preserve, with Mt. Wrangell, part of the Wrangell Volcanic Field, the source of the 25-50 cubic kilometer White River ash, erupted 1900 and 1250 years ago; Lake Clark National Park and Preserve where ash from the 1989 eruption of Mt. Redoubt caused more than \$100 million in damage to a single 747 aircraft and mudflows threatened a major oil terminal. Aircraft hazards are a particular issue in Alaska because of the concentration of volcanoes near the primary air routes between North America and Asia. Anchorage handles the largest cargo volume of any airport in the world.
- ▶ At Hawaii Volcanoes National Park, Kilauea has produced more than a cubic kilometer of lava since its eruption began in 1983, covering 181 buildings, including a park visitor center. Although best known for the repeated production of lava flows, recent work has revealed that its explosive eruptions are about as frequent as at Mt. St. Helens. Kilauea's current eruption is the largest stationary source of pollution on the island of Hawaii, emitting 1000-1500 tons of pollutants per day from the eruptive area, exceeding the emissions from the nation's dirtiest power plant. Although there are no conclusive links to health effects, Hawaii has an asthma death rate that is the highest in the United States.
- ▶ Huge caldera-forming eruptions occurred at Yellowstone 2 million, 1.3 million and 650,000 years ago, with smaller eruptions continuing since then. A dynamic geothermal system frequently develops new thermal features, and hydrothermal explosions have formed large vents in Yellowstone Lake. The August 1959 Hebgen Lake earthquake just northwest of Yellowstone killed 28 people and produced a 5.7-meter scarp. Since 1923 documented evidence indicates both significant uplift and subsidence that may represent magma movement or changes to the hydrothermal system.
- ▶ Eruptions of Mt. Rainier in the 19th century were small. The last large eruption 1100 years ago sent mudflows to Puget Sound. Collapse of part of the volcano 5600 years ago produced the major Osceola Mudflow. There are 4.4 cubic kilometers of snow and ice on the volcano subject to catastrophic melting in future eruptions. Hydrothermal activity has altered the volcanic rock which forms Mt. Rainier, weakening the slopes of the volcano.
- ▶ Lassen Volcanic National Park was established by Congress in 1916 after an eruption that began 2 years earlier culminated in explosions that destroyed a new summit lava dome, producing a large eruption cloud, pyroclastic flows, and mudflows. Much of the park is within USGS-delineated hazard zones at risk for impacts similar to those from the 1914-17 eruption
- ▶ The lava field at Craters of the Moon National Monument is composed of at least 60 flows totaling 30 cubic kilometers, with spectacular flow features, eruptive fissures and cones, lava tubes, and rafted blocks. Significant damage has occurred to brittle and unstable surfaces in heavily visited areas. The National Monument was recently expanded to include most of the Great Rift, 85 km long and 2-8 km wide, multiplying the protected area tenfold. About two-thirds of the enlarged Monument will be administered by the NPS, and one-third by the Bureau of Land Management.
- ▶ With more than 450 caves in 12 lava tube systems, Lava Beds National Monument has the largest concentration of lava tube caves in the 48 conterminous states. The caves host 14 species of bats, including maternity colonies and hibernacula. About 70,000 visitors per year enter caves. Visitor impacts to bats, archeological resources, flora in cave entrances, speleothems, ice features, and bacteria are a great concern to the park managers. Only about 1% of the lava caves are gated, and many visitors are on interpreter-led tours.

Geologist-in-the-Parks Program

By Judy Geniac, Environmental Protection Specialist

The Geologic Resources Division established the Geologist-in-the-Parks (GIP) Program in 1996 to facilitate the placement of geology students, professional geologists, college professors, and retired geology professionals in our national parks. While the Program helps parks fill both permanent and seasonal positions, the heart of the program is in helping parks accomplish geology-related projects through funded volunteer geology positions. The Program has grown considerably since its first placement of 6 geologists in 1996.

The Program placed 46 geologists in more than 36 parks in 1999 and 48 geologists in more than 35 parks in 2000. While the Program continues to grow, the Division has begun to examine the possibility of expanding of the Program to address additional physical, ecologic, or integrated science needs as GeoScientists-in-the-Parks (see inset box). The success of the program in 1999 and 2000 is due largely to our ability to form partnerships with the parks and NPS regional offices, the Geological Society of America, the Student Conservation Association, the Association of Women in Geoscience, and the National Association of Black Geoscientists and Geophysicists.

The GIP Program benefits the parks as well as the individual participants. Through a variety of activities, GIP participants help park staff and visitors understand the scientific discoveries that are improving our knowledge of past geologic changes, unveil the role geology plays in managing our natural resources, and forecast possible scenarios of the earth's geologic and ecologic future. At the same time, park staffs are able to share their knowledge with the GIPs of other park resources, their own observations, and their expertise in resource management, research, and interpretation. The program has developed into a win-win experience for all parties involved. There is a wealth of examples to draw upon. The following is a small sample of the individuals who have participated in the program.

Professor Robert Lillie, of Oregon State University, began his work in 1998 and continued the work as the Program's first "Professor-on-Sabbatical." He dedicated his own time to respond to reviews of



GIP Growing into GeoScientist-in-the-Parks Program

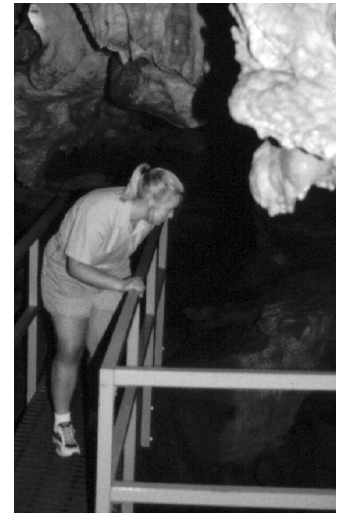
The success of the Geologist-in-the-Parks Program is turning heads! Parks are elated with the projects being accomplished and everyone sees this program as a real asset. The Division managers within the Natural Resource Program Center have agreed to a 2 year pilot project to expand the GIP Program into one that places a variety of scientists. The majority of the positions will continue to be funded through partners who will advertise for candidates and will provide the associated stipends. The positions will go beyond the current focus of geology to include other geoscience positions such as hydrology, water quality, air quality, and integrated ecological positions.

his draft geology training manuals designed specifically for Blue Ridge Parkway, Gulf Islands National Seashore, and Sunset Crater National Monument. In the summer of 1999, Yellowstone National Park hired Professor Lillie as a seasonal interpretive ranger with a gracious invitation to continue to work with other parks on the training manuals and to prepare to work for yet two other national parks, Olympic and Mount Rainier. Upon completing Yellowstone's preseason interpretive training, Dr. Lillie stated that his newly-learned interpretive techniques would help

him communicate with visitors, improve his writing in the park training manuals, and improve his teaching. The Division was impressed with the simple, dynamic, and memorable presentations he had given in other parks prior to this training. Given new skills in interpretation, many staff within the Service are looking forward to his future work in the parks. Professor Lillie has begun partnering his graduate students with parks to develop many more park-specific geologic training manuals. Professor Lillie's

expertise lies in plate tectonics and he is using the materials he has gathered to author a book called *Parks and Plates: How the Earth's Dynamic Forces Shape Our National Parks*.

Mary Barnes spied a notice about the GIP Program in the geology department at the University of Washington, Seattle. After graduating with a bachelors degree in geology, she decided to take a yearlong hiatus before going to graduate school. Desiring some hands-on experience, she applied for a GIP position at Oregon Caves National Monument, a position sponsored by the Geological Society of America. The staff at Oregon Caves were impressed with her enthusiasm, her drive, and her ability to complete so many projects. She did some surface mapping and developed a structural geologic map of a portion of the monument. To determine baseline hydrologic flow rates and directions she conducted a dye tracing project. Mary also sampled sediment sites within the cave and sent them to a lab to have then analyzed for microfossils. To round out her experience, she provided interpretive talks to the general public in which she explained the wonders of the cave



formations. She prepared a well-written summary report of her work as part of the requirement of her internship.

Josh Smith discovered the GIP Program through the Utah Geological Survey. A student at the University of Southwestern Louisiana, at Lafayette, he applied for and started a career in paleontology at Zion National Park. He dedicated himself and his time (60 hours per week) to identify and inventory the fossil resources of the park. He received some training at Death Valley National Park from NPS paleontologist, Vince Santucci. Josh traveled extensively throughout the Death Valley collecting Global Positioning System (GPS) data, digital photographs, and site information which he noted on the Utah Geological Survey's site form. He worked at 30 sites in the park, mainly looking at vertebrate tracks. He has written a report on his work, and the park asked him to return for the summer season 1999 to continue his work. Josh notes that he "had a blast!" His heart is set on doing other paleontological work on federal lands. He moved on to help Fossil Butte National Monument during the winter months. With only 6 credits needed to complete his Bachelor's degree, he will finish school soon. ◆



Colorado School of Mines Sand Trap Research Project

By Philip Cloues, Mining Engineer

The Geologic Resources Division partnered with the Colorado School of Mines (CSM) through a senior engineering partnership to design and build a sand trap to collect drifting sand dune particles. CSM engineering students finished the project on time, in 1999, and for less than \$500 total outlay for materials. This low budget research project may provide a new opportunity to advance the knowledge of sand dune migration and provide a monitoring tool for detection of outside deleterious influences on this dynamic geologic resource. Eventually, the new tool could find application to sand dune research in over 25 park units.

The two-semester effort resulted in computer generated engineering drawings, a technical report, and a complete prototype model of the sand flux device by four graduating mechanical engineers. Steven Fryberger, who has worked at White Sands National Monument and Great Sand Dunes National Monument on sand dune migration research, took possession of the client product in mid-December, and tested the device at White Sands.

Phase II of the sand trap project deployed another team of engineering students to improve the device in 2000. The collector head was redesigned to improve its collection accuracy by eliminating sharp angles around the exhaust ports. The head now resembles a vertically symmetrical airplane wing with the sand collection orifice in the leading edge. Design changes also include a battery powered computer circuit to close the collection orifice during precipitation to prevent clogging, or if a collection bin becomes full. The redesign of the internal sand distribution system prevents spillage from one collection bin to the next, improves the head rotation bearing, and employs more durable construction materials. The device has been sent to Aberdeen, Scotland for field testing and calibration in partnership with the university and the instrument's inventor.

Cooperative research by partnering with universities provides an opportunity for students to apply their skills to solve real-world problems. In this case, research will greatly contribute to the ability of the NPS to obtain cost effective tools to resolve complex natural resource issues like dune monitoring and sand flux changes due to changes in the surrounding conditions. ◆

Program Center Takes On Geologic Resources Inventories

By Bruce Heise and Tim Connors, Geologists

In 1999 and 2000, the Division continued a pilot program that will ultimately inventory the geologic resources of the National Park System. Working closely with involved parks and the Natural Resource Information Division, the Division has initiated work on the Geologic Resources Inventory in nearly 70 parks. The effort identifies ways to enhance overall park resource management through the inclusion of the park's geology in the information available to park decision makers.

Bedrock and surficial geologic maps and supporting information provide the foundation for studies of groundwater, geomorphology, soils, and environmental hazards. They describe the underlying physical habitat of many natural systems that are integral components of an ecosystem. The



Utah Geological Survey geologists showcase new cost-shared geological mapping during a scoping session at Zion National Park, UT.

NPS Geologic Resources Inventory is a cooperative endeavor to implement a systematic, comprehensive, inventory of the geologic resources in NPS units. Cooperators include the NPS Geologic Resources Division, NPS Inventory and Monitoring Program (Natural Resource Information Division), U.S. Geological Survey (USGS), individual state geological surveys, and numerous academic institutions. The parks in three states, Colorado, Utah, and North Carolina, were selected for a pilot study. The Geo-

logic Resources Inventory consists of four components (See sidebar). The description and status of each is described below. Park specific status is presented in Table 1.

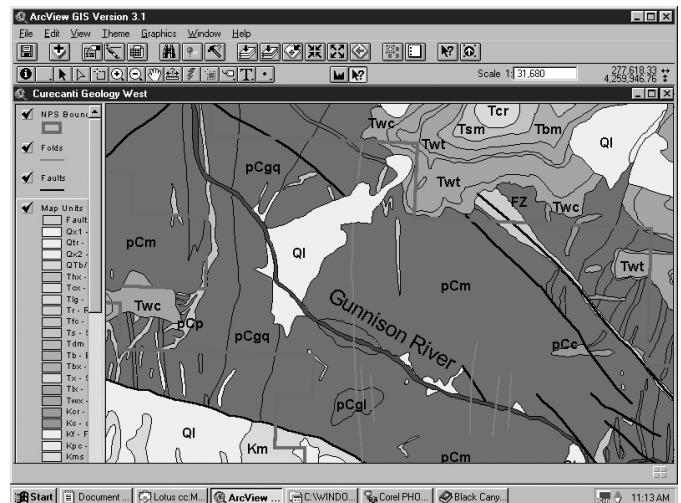
Status of Geologic Resource Inventories

Geologic Bibliographies - A park specific geologic bibliography is compiled from a list of known existing geologic maps and literature. Keyword database searches are conducted on the American Geologic Institute's GEOREF, the USGS GEOINDEX, and park supplied Procite databases. After compiling the bibliography, data validation involves reviewing for duplicate citations, typographical errors, missing or inaccurate data, and the relevance to the park unit. To date, Geologic Bibliographies have been validated for 68 parks (see Table for specifics). These data are available on the internet (<http://165.83.36.151/biblios/geobib.nsf> LOGIN: "geobib read" PASSWORD: "anybody") and are also available to download as printable documents from <http://www2.nature.nps.gov/grd/geology/gri/products/geobib>.

Scoping Sessions - Park scoping sessions provide an opportunity for experts on a park's geology to share their knowl-

edge with park and Natural Resource Program Center staff. Session participants are recommended by the parks and brought in by the Geologic Resources Inventory team. Session participants routinely spend one day in the field and another day in discussions devoted to evaluating existing maps for quality and coverage, digital map and report availability, and if necessary, additional needed geologic mapping. New geologic mapping may be initiated on a case-by-case basis after careful evaluation of needs, costs, potential cooperators, and funding sources. To date 32 sessions on 37 parks have been conducted in Colorado, Utah, North Carolina, Idaho and Minnesota. Over 200 people, representing 5 federal agencies, 8 state surveys, 15 academic institutions, and 15 other entities, have participated in these meetings. While directed toward the inventory, the meetings also serve a greater function of educating park staff on geology, geologic processes, and geologic resources. Reports for each session are posted on the internet at <http://www2.nature.nps.gov/grd/geology/gri>.

Digital Geologic Maps - Geologic maps constitute the keystone of the Geologic Resources Inventory. Geologic maps have been used in many ways beyond those commonly attributed to them. Examples include the use of geologic data to construct fire histories, to identify habitat for rare and endangered plant and animal species, identify areas with cultural resource and paleontological potential, and to locate potential hazards for park roads, facilities and visitors. Digital geologic maps will enhance the ability to develop precise hazard and resource models in conjunction with other digital data. Of the 35 parks scoped to



Section of digital geologic map of Black Canyon of the Gunnison National Monument displayed in ArcView GIS format.

date, Geologic Resources Inventory staff have digitized and attributed 13 parks, with the other 22 in progress, and more planned for 2001. When possible, the Geologic Resources Inventory will fund or cost share with another entity to acquire a complete map. Additionally, the Geologic Resources Inventory team is working with 6 other, non-scoped, parks to complete digitizing of existing maps.

Geologic Reports - The report is intended for use as a resource management tool. A typical report would address the geologic setting, stratigraphy, structure, unique geologic and paleontological resources, and geologic hazards and issues. Preparing these reports will require a dedicated effort. To this end, Geologic Resources Inventory funds are now used to support a research associate position (at Colorado State University) to prepare park specific reports.

Eleven Utah parks are covered in a single volume produced by the Utah Geologic Association and heavily supported with Geologic Resources Inventory funds. Three other parks have draft reports in-progress with anticipated completion in 2001. Additionally, Geologic Resources Inventory funds were used in the publication of a USGS Professional Paper on the geology of Wrangell-St. Elias that will serve as that park's report.

Geologic Resources Inventory Status By Park

State	Park Name	FY Scoped	Geologic Bibliography	Digital Geologic Map	Geologic Report
AZ	Glen Canyon NRA	1999	validated	In progress	Completed by Utah Geological Association
AZ	Rainbow Bridge NM	1999	validated	In progress	Completed by Utah Geological Association
CA	Death Valley NP	1999	In progress	In progress	In progress
CA	Lassen Volcanic NP	2000	validated	In progress	In progress by USGS
CO	Bent's Old Fort NHS	1999	validated	Digitized	In progress
CO	Black Canyon of the Gunnison NM	1998	validated	Digitized	In progress
CO	Colorado NM	1998	validated	Digitized	In progress by USGS
CO	Curecanti NRA	1998	validated	Digitized	In progress
CO	Dinosaur NM	1998	validated	Digitized	Completed by Utah Geological Association
CO	Florissant Fossil Beds NM	1999	validated	Digitized	In progress
CO	Great Sand Dunes NM	1998	validated	Digitized	In progress
CO	Hovenweep NM	2000	validated	In progress	In progress
CO	Mesa Verde NP	1998	validated	Digitized	In progress
CO	Rocky Mountain NP	1998	validated	Digitized	In progress
CO	Yucca House NM	1998	validated	In progress	In progress
ID	City of Rocks N RES	1999	validated	In progress	In progress by USGS
ID	Craters of the Moon NM	1999	validated	Digitized	In progress
MN	Voyageurs NP	2000	validated	In progress	In progress by USGS
NC	Blue Ridge Parkway	2000	validated	In progress	In progress
NC	Cape Hatteras NS	2000	validated	In progress	In progress
NC	Cape Lookout NS	2000	validated	In progress	In progress
NC	Carl Sandburg Home NHS	2000	validated	In progress	In progress
NC	Guilford Courthouse NMP	2000	validated	In progress	In progress
NC	Kings Mountain NMP	2000	validated	In progress	In progress
NC	Moore's Creek NB	2000	validated	In progress	In progress
TN	Great Smoky Mountains NP	2000	validated	In progress	In progress by USGS
UT	Arches NP	1999	validated	Digitized	Completed by Utah Geological Association
UT	Bryce Canyon NP	1999	validated	In progress	Completed by Utah Geological Association
UT	Canyonlands NP	1999	validated	In progress	Completed by Utah Geological Association
UT	Capitol Reef NP	1999	validated	In progress	Completed by Utah Geological Association
UT	Cedar Breaks NM	1999	validated	In progress	Completed by Utah Geological Association
UT	Golden Spike NHS	1999	validated	Digitized	In progress by USGS
UT	Natural Bridges NM	1999	validated	Digitized	Completed by Utah Geological Association
UT	Timpanogos Cave NM	1999	validated	In progress	Completed by Utah Geological Association
UT	Zion NP	1999	validated	In progress	Completed by Utah Geological Association

Geologic Resources Inventory Plans for 2001

Geologic Resources Inventory efforts in 2001 will be largely dedicated to completing ongoing mapping, digitizing, and reports. New scoping is planned for parks in Texas and New Mexico, the National Capital Region, and the southern Colorado Plateau. Parks knowing of existing geologic mapping projects and parks interested in initiating a geologic resource inventory should contact the Geologic Resources Division to determine support availability. ◆

ing a geologic resource inventory should contact the Geologic Resources Division to determine support availability. ◆

What is the Geologic Resources Inventory?

Geology is one of twelve disciplines identified in NPS 75 and the 1997 Strategic Plan as items the National Park Service should inventory to assist with science-based resource management. At a November 1997 meeting, NPS, USGS, and state geologists identified a Servicewide inventory of the National Park Systems' geological resources as a critical first step for managing, interpreting, and understanding these same resources. The group determined that a Geologic Resources Inventory should consist of these four park specific components:

- ▶ GRBib, a compilation of geologic literature and maps;
- ▶ Scoping sessions, on-site evaluations of park geologic maps, resources, and issues;
- ▶ Digital geologic map products with accompanying supporting information; and
- ▶ A summary report with basic geologic information on hazards, issues, and existing data and studies.

The intent of the Geologic Resource Inventory is to provide each of the natural resource parks with this information.

How will Geologic Resources Inventory information be available, and how can it be used?

Geologic Resources Inventory staff are developing geologic-GIS standards to ensure uniform data quantity and quality for digital geologic maps. In addition to standardized data definitions and structure, NPS resource managers also need user-friendly GIS applications that allow the digital geologic map products to "look and feel" like the original published paper maps. Applications, including the NPS-developed ArcView Data Browser, graphical cross section viewer and legend text display tools are integrated with a standard geology-GIS model that is in development. The evolving geology-GIS model is based on the Washington State ArcInfo GIS data model (Harris 1998) that is being adapted for ArcView GIS and extended to include components of the North American Geologic Map Data Model (NADM), <http://geology.usgs.gov/dm>

Park specific geologic databases will be available for download from the National Park Service Geographic Information System Clearinghouse, complete with Federal Government Data Clearinghouse compliant metadata at <http://www.nps.gov/gis>

Tapping Our Boundaries: External Mineral Development and the NPS

By Kerry Moss, Environmental Protection Specialist

The past two years have proven to be a busy time helping parks contend with mineral development proposals adjacent to park boundaries. Such development has the potential for cross-boundary effects. At the request of parks, regions, and various central offices, the Division examined mineral development proposals and ongoing operations ranging from small-scale coal mining in Appalachia, potentially affecting ground or surface waters, to a large, internationally significant uranium mine in Australia that could adversely affect the environment and the indigenous peoples who call the land their home.

Generally speaking, mineral operations are often proposed on adjacent Federal lands administered by the Bureau of Land Management (BLM) or the United States Forest Service (USFS), state lands, and privately owned lands. However, as has been the case in past years, public park officials in other countries, as well as the United Nations, have tapped the National Park Service expertise in minerals planning, regulatory oversight, mineral operations, and impact mitigation.

NPS concerns over adjacent mineral proposals center around the possibility of adverse impacts to park resources and values. Often the same geologic features that are responsible for the spectacular scenery and unique resources contained in many units of the National Park System also host sought-after minerals on adjacent lands. Further complicating the external minerals issue is the fact that NPS boundary lines do not often follow watershed boundary lines which determine if any given park unit may receive runoff from an adjacent mineral operation. Impacts on visual resources as seen from park units are even more difficult to control. Transportation of raw minerals near or through NPS units to beneficiation or sales points is another issue that often surfaces in connection with external mineral operations.

The NPS has the ability to control impacts resulting from mineral extraction inside our boundaries through regulations found at 36 CFR Part 9A (minerals located under the 1872 Mining Law), 36 CFR Part 9B (non-federal oil and gas), and 36 CFR Parts 1-6 (all other private minerals). However, to date, we have had only limited success in extending the mandate of the Organic Act to conserve park resources and values to areas outside NPS boundaries - even if the potential exists for derogation of park resources and values from adjacent mineral activities. Surface coal mining is the exception to this rule since enactment of the Surface Mining Control and Reclamation Act of 1977 which contains specific provisions that protect units of the Park System. In addition, a recent Solicitor's opinion has also confirmed that the Secretary of the Interior may intercede in the issuance of hardrock mineral leases by the BLM if the proposed mining operation has the potential to adversely affect an adjacent park unit.

Possible impacts from adjacent mineral operations are numerous. Oil and gas operations have the potential to affect ground and surface waters, air quality, visual resources, natural soundscapes, night skies, and visitor safety. Transportation of oil and gas products or by-products, whether that transportation is by truck or pipeline can also adversely affect visitors, natural resources, and cultural resources.

Solid mineral mining operations, both underground or surface mining, often have the same type of adverse effects as oil and gas operations. However, due to the larger size of mining operations over drilling operations, and the inherent risk factors involved with moving large amounts of earth, the size and scope of impacts to visitors, natural resources, and cultural resource can dwarf those impacts from oil and gas drilling and production operations.

Considering the lack of direct regulatory authority available to the NPS on external mineral operations through the past two years, the Service found it most advantageous to communicate NPS resource concerns to other mineral operation permitting agencies through those agencies' permitting processes. Most local, state, and federal permitting authorities offer opportunities for public input in their permitting process.

Many projects have been and will be carried over into the Geologic Resources Division's year 2001 work plan. The effort to protect park resources from external mineral development is often a long and arduous process wherein the NPS must attempt to make other land management agencies, and sometimes private land owners, understand the goals of the NPS mission and the importance of the resources we protect. Most entities value park resources and want to protect them too. In 1999 and 2000, the Division, coupled with the expertise of park managers and staff was able to secure park protection measures from external permitting agencies. The successful track record underscores the importance of teamwork and the appeal of the park protection message. ◆

Mineral Appraisal Program Sees Another Busy Year

By Philip Cloues, Mining Engineer

Technical reviews of mineral appraisals provided by third party contractors provide consistency and uniformity to the accepted appraisal standards. Consulting to find a qualified mineral appraiser, reviewing a contract, answering questions on methodology, and discussing specific mineral commodities are essential to ensure that fair market value is obtained in the lands acquisition program. Often mineral rights play a significant role in determining "highest and best use." Projects and assistance in 1999 and 2000 included:

- ▶ 5 placer claim groups at Wrangell-St. Elias National Park and Preserve
- ▶ 4 placer claim groups at Denali National Park
- ▶ 1 unpatented talc mine at Death Valley National Park
- ▶ 1 coal appraisal at Big South Fork National River and Recreation Area
- ▶ 1 private mineral inholding at Olympic National Park
- ▶ 1 mineral material claim group at Mojave National Preserve
- ▶ 1 agate mineral theft case at Big Bend National Park
- ▶ 1 mineral material site at Cuyahoga Valley National Recreation Area
- ▶ 1 oil and gas potential buyout at Tallgrass Prairie National Preserve
- ▶ 1 Andalex/Pacific coal buyout for Grand Staircase/ Escalante NM with BLM
- ▶ 1 SOL/BIA mineral appraisal update for Arkansas River Indian Project
- ▶ 1 mineral material appraisal at Hopewell Culture National Monument
- ▶ 1 Federal Court Case Trial (KMC vs Babbitt at \$700,000 versus \$8.4 million)

Information and data from the market arena is often difficult to find for particular mineral commodities. But a thorough search usually allows a skilled and qualified mineral appraiser to establish a reasonable estimate of fair market value for negotiation purposes. If demonstrated or proven reserves cannot be determined, the highest and best use may be as a potential mineral prospect if located in a favorable geologic setting. When all factors effecting value are considered, the value usually falls into the right ballpark. ◆

Division Continues to Play Key Role in Non-federal Oil and Gas Management Programs

By Ed Kassman, Policy and Regulations Specialist

The Division provides policy and regulatory support to parks having nonfederal oil and gas mineral rights within and adjacent to its borders. Since 1979, the Park Service has managed non-federal oil and gas rights in parks via regulations at 36 CFR Part 9, Subpart B, known as the 9B regulations. Through these regulations parks can minimize or avoid resource degradation caused by oil and gas exploration and development. The Division, in concert with the Solicitor's office, assists parks in implementing these regulations in a consistent and effective manner. The following cases highlight the Division's assistance in this arena in 1999 and 2000.

Holding The Line On Servicewide Policy At Big Cypress National Preserve

In south Florida, Collier Resources Company (CRC) kept Big Cypress National Preserve and the Division busy in 1999 and 2000 with 24 oil and gas plans of operation, ranging from 3-D seismic operations to exploratory wells to conventional seismic operations. Collier Resources is conducting oil and gas exploration and development for the Collier family, which holds vast tracts of mineral interests beneath the Preserve. The Division reviewed all of Collier's plans for technical adequacy and found that, among other things, that the company failed to provide complete documentation that it has a right to operate in all of the proposed plan areas. The company has maintained that it would provide this information after the NPS reviewed and approved its plans, contrary to the Service's policy embodied in the 9B regulations.

If an operator does not hold a legal right to conduct an oil and gas operation in a park, then the NPS has no legal obligation to allow that operation. The NPS does not wish to spend the time and money to formally review a plan of operations if the operator has not demonstrated mineral ownership and may be unable to do so. The 9B regulations require that an operator provide the NPS with a "copy of the lease, deed, designation of operator, or assignment of rights upon which the operator's right to conduct operations is based" [36 CFR §9.36(a)(2)].

As follow-up to the plan review, the Division worked closely with Departmental Solicitors to assist park staff in responding to each of Collier's plans and in assisting the park in devising an overall strategy to handle the Collier's persistent pressure to approve the plans. The park has not wavered in its position on this policy issue thereby maintaining the integrity of this policy Servicewide.

Division Assists Tallgrass Prairie National Preserve in Obtaining Solicitor's Opinion

On November 12, 1996, Congress set aside approximately 10,894 acres near Cottonwood Falls, Kansas to establish the Tallgrass Prairie National Preserve. The park's enabling legislation states that the United States can acquire mineral rights by donation. The NPS will administer up to 180 acres of

the 10,000 acres with the National Park Trust, a private entity owning the remaining land. A 35-year term oil and gas lease encumbers the entire park. Approximately 27 gas wells, associated pipelines, and facilities are located primarily in the northern section of the park.

As the new superintendent assumed his duties at the Preserve, he became concerned with the ability of the NPS to regulate the potentially adverse effects from these gas operations. The superintendent, recognizing that conflicting provisions in the park's enabling legislation seemed to limit the ability of the park to regulate, called on the Division for assistance.

At issue are three provisions of the legislation. One provision allows Park Service laws and regulations to be applied on the 180 acres that the United States would acquire by donation. Another provision states that the NPS may apply its regulations on private property with the consent of the landowner. A third provision, however, specifically exempts the application of NPS laws and regulations outside the 180 acres. Read together, it appeared that even with the consent of a landowner, the NPS could not apply its regulatory authority outside the 180 acres.

The Division reviewed the enabling legislation and, in 1999, drafted a request to the Rocky Mountain Regional Solicitor for an interpretation of the statutory provisions that would maximize the authority of the superintendent to control oil and gas and other activities within the entire park. In a written opinion, the Regional Solicitor recommended that outside the 180 acres of land the NPS would be best served by entering into a carefully constructed lease agreement with the National Park Trust. With a federal property interest outside the 180 acres and with the consent of the landowner, the NPS has a sound basis to exercise regulatory authority over oil and gas activities that could adversely impact the park. This opinion has resolved conflicting statutory provisions and offered to the superintendent an effective option to protect the new park's resources and values.

Clarification of Mineral Rights at Gulf Islands National Seashore

The oil and gas industry is allocating large amounts of money into three-dimensional seismic exploration along the Gulf of Mexico coastline. 3-D exploration is a relatively new method of data gathering and interpretation. The result is a three-dimensional image of the subsurface geology that can help oil and gas companies more accurately predict where oil and gas resources exist.

With the Division's assistance in interpreting and applying the 9B regulations, Gulf coast parks in the path of this wave of exploration activity have successfully managed these operations to prevent or mitigate adverse impacts to park resources and values. Gulf Islands National Seashore was faced with one such proposal, but instead of using the 9Bs it addressed this resource threat in a different manner.

The park had been relying on guidance that stated that the State of Mississippi held the mineral interest underlying submerged lands out to one mile offshore in the Gulf of Mexico. Consequently, the park assumed that oil and gas exploration and development must be permitted in the park under the 9B regulations. In 1998 however, when a 3-D seismic company, Fairfield Industries, approached the park to conduct exploration in park waters, a park resource manager examined the deed transferring the submerged lands from Mississippi to the United States and questioned the long standing conclusion.

Under the plain language of the deed, Mississippi retained a right to the minerals beneath the park, but that right allowed it to exploit the minerals only from outside the boundary of the park. The park contacted the Division to assist in interpreting the deed language and in preparing a request for a Solicitor's opinion to resolve this issue.

In September 1999, the Southeastern Regional Solicitor issued an opinion generally concluding, "the United States owns the mineral estate to the lands conveyed, but that the State of Mississippi has reserved the right to exploit the minerals as long as such exploitation is conducted outside the Seashore." The Solicitor also agreed that the park acted appropriately in denying Fairfield's request to conduct 3-D seismic operations inside the park boundary. In 2000, Congressional efforts failed to legislatively grant the mineral estate beneath Gulf Islands to the state of Mississippi as part of a park land acquisition bill. For now, park waters remain off limits to oil and gas operations. ◆

Nonfederal Oil and Gas Management Planning Update

By Lisa Norby, Petroleum Geologist

In 1999 and 2000, the Division continued to provide substantial technical support to park and Intermountain regional staffs in the preparation of programmatic plans/environmental impact statements (Plan/EIS) to guide the long-term management of nonfederal oil and gas development in the following three park units in Texas: Padre Island National Seashore, Big Thicket National Preserve, and Lake Meredith National Recreation Area/Alibates Flint Quarries National Monument. The plans will help oil and gas operators prepare for, and conduct their operations by clearly articulating park-wide resource protection performance goals, operating stipulations, and recommended mitigation measures. The guidance information is designed to further protect park resources, uses, values, and human health and safety while still allowing for development of the nonfederal mineral interest in the parks. The management plans will also facilitate NPS oversight of nonfederal oil and gas development in the three parks.

In the past, Padre Island, Big Thicket and Lake Meredith did not have an up front, comprehensive planning framework to facilitate oil and gas related management decisions. Implementation of the new programmatic management plans will enhance consistent application of legal and policy requirements and resource protection measures throughout the three parks.

In an effort to develop comprehensive management plans, the NPS has worked closely with numerous oil and gas and environmental subject matter experts including:

- ▶ U.S. Geological Survey
- ▶ U.S. Bureau of Reclamation
- ▶ Railroad Commission of Texas
- ▶ U.S. Fish and Wildlife Service
- ▶ National Marine Fisheries Service
- ▶ Texas Parks and Wildlife Department
- ▶ Texas State Historic Preservation Office\
- ▶ NPS Natural Resources Program Center
- ▶ Colorado School of Mines
- ▶ Numerous Native American tribes
- ▶ Oil and gas company personnel and other consultants

These entities provided baseline data and helped assess potential impacts of the proposed alternatives in the plan. Geographic Information Systems have been used to delineate areas of the three parks that are particularly susceptible to adverse impacts from oil and gas operations. In these areas, specific measures such as the timing of operations and surface use stipulations have been developed to protect park resources, uses, values, and human health and safety.

The NPS has made considerable progress over the past two years to move these plans forward. This progress includes:



This producing oil well is located near a steep drainage at Lake Meredith National Recreation Area. Stained soils around the pumpjack indicate persistent and recurring leaks. There is no secondary containment to prevent leaks and spills from being released into the environment.



Example of a well conducted gas production operation at Lake Meredith National Recreation Area, Texas.

- ▶ Padre Island National Seashore put the draft Plan /EIS out for public review and comment from February 26 through May 12, 1999. Fifteen comment letters were received on the draft plan. The planning team formulated responses to the comments and modifications to the text in the Plan/EIS. The final Plan/EIS was released for the 30-day No Action period on March 3, 2000. The Record of Decision was signed on October 12, 2000. The Record of Decision describes the alternative selected for implementation, the rationale for the decision, other alternatives considered in the plan, and resource protection measures required under the selected alternative.
- ▶ Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument will release their draft Oil and Gas Management Plan/EIS for public review during the spring of 2001.
- ▶ Big Thicket National Preserve is currently revising the Preserve's draft Plan/EIS with an anticipated public review period during the fall of 2001.

As each Plan/EIS is completed, staff from each of the three parks will prepare a concise, park-specific final plan describing the selected alternative, affected environment, and environmental impacts associated with nonfederal oil and gas development in the park. The plan will also include detailed maps of resource areas that are susceptible to adverse impacts from oil and gas operations, a description of applicable laws and regulations, and mitigation measures to guide nonfederal oil and gas operators in planning exploration and production operations.

In addition the Division has started assembling an Operator's Handbook for Nonfederal Oil and Gas Development on NPS lands. This handbook will cover all aspects of the 36CFR 9B regulatory permitting process and will describe other legal and policy requirements that must be met by nonfederal oil and gas operators. Once completed, this handbook will help operators better understand the 9B regulations, prepare a Plan of Operations, comply with all legal and regulatory requirements, and develop their oil and gas resources underlying park units. ◆

Cost Sharing Arrangement Gets Oil and Gas Wells Plugged at Cuyahoga Valley

By Pat O'Dell, Petroleum Engineer

Past oil and gas development by mostly small, private companies has left a legacy of orphaned and unplugged oil and gas wells in Cuyahoga Valley National Recreational Area. An orphaned well is an abandoned well with no known owner. During 1999, the park was able to permanently plug five of them. A 50/50 cost sharing arrangement with the State of Ohio helped make the five well pluggings possible. Over the years, the park has plugged a total of 49 orphaned wells.

Even if an open well is not constantly leaking oil and gas to the surface, it is a likely source of future problems as downhole mechanical conditions deteriorate or pressure changes occur in the exposed hydrocarbon zones. Also, unplugged wells may be actively polluting groundwater zones that have a direct path of contact to hydrocarbon-bearing strata. In addition to abating the ongoing actual and threatened natural resource degradation stemming from unplugged wells, the 1999 well-plugging project reduced safety hazards from wells venting natural gas.

Though well plugging is at times a complicated technical undertaking, Meg Plona, the park's oil and gas specialist, would probably tell you that well plugging at Cuyahoga Valley NRA is "easier done than said." Park staff worked to overcome bidding and contracting obstacles. The difficulties stemmed from a lack of available well records and from liability issues associated with reclamation of an old drilling pit associated with one of the wells. The majority of oil and gas wells in Cuyahoga Valley predate state permit requirements and as a result, specific well details are scarce. The drilling pit involved had obvious signs of hydrocarbon contamination and contractors feared what might be found once they disturbed the surface. Too many "unknowns" scared off potential contractors or resulted in extremely high bids.

To move the project forward and not lose the matching funds, Cuyahoga issued a new bid solicitation that removed surface reclamation of existing disturbance from the scope of work. In addition, Division staff conducted onsite inspections, gathered all available well data, and made inferences from what was known about nearby wells to rewrite the plugging specifications. Once a contractor was finally in place, the actual work proceeded smoothly. Ultimately, the park was able to plug five wells for about \$100,000 using matching funds from the State of Ohio.

For surface reclamation, the park modified a separate, ongoing contract for reclamation of other park areas not associated with oil and gas. Surface restoration of the five well sites included removal of well equipment and materials (including the pit contents), grading of the site to reestablish natural contours, placement of topsoil as needed, and seeding. The add-on cost was about \$6000 for all five locations with

the majority of expense going towards removal and disposal of the drilling pit contents.

The park has identified at least a half dozen more orphaned wells in need of plugging. Although matching funds from the state appear to have dried up, this year's bidding and contract exercises will at least make the paperwork easier in the future. ◆

Gulf Islands and Southeast Region Concerned About Gas Development in the Gulf of Mexico

The Division assisted Gulf Islands National Seashore in commenting on a draft EIS for Chevron's proposed offshore, multi-well gas project at Destin Dome Unit #56. Division comments cited potential impacts to NPS lands from the proposed development. The NPS is concerned that the operations could result in accidental spills of diesel fuel, corrosion inhibiting solvents and debris that could adversely impact visitor uses and experiences, park beaches, and bird and wildlife species in and adjacent to the park. The State of Florida objected to Chevron's proposal pursuant to the Coastal Zone Management Act. Because of the objections raised by the state and others, the National Oceanic and Atmospheric Administration, the permitting agency, has not yet approved the project. The oil company asserts that the plan is in compliance with the Coastal Zone Management Act and the delays it has experienced in moving this project forward constitute a "takings" of the company's federal lease. To date the project is still not moving forward pending the outcome of the Coastal Zone Management Act consistency determination.

Nonfederal Oil and Gas Management Program Highlights

By Pat O'Dell, Petroleum Engineer

Active Operations Summary

The Division updated its inventory of active nonfederal oil and gas operations in park units, including the addition of 25 natural gas wells in the recently established Tallgrass Prairie National Preserve. Currently, there are nearly 700 oil and gas wells operating in 12 park units (see table). The Tallgrass Prairie National Preserve in the Flint Hills region of Kansas became a park unit in 1996. The preserve protects a nationally significant example of the once vast Tallgrass ecosystem.

Tallgrass Prairie National Preserve is a new kind of National Park System unit. It is approximately 11,000 acres in size, but most of that land will remain under the ownership of the National Park Trust. The NPS will own up to 180 acres, yet the legislation calls for the entire acreage to be managed cooperatively by the Service and the National Park Trust. Fortunately, the gas operations in the park are relatively benign, but abandoned pipelines and unmaintained roads contribute to some erosion problems.

The NPS manages private oil and gas operations under its regulations at Title 36, Code of Federal Regulations, Part 9, Subpart B (9B regulations). The table includes a column listing the number of unregulated operations. In many cases, the ability of the Park Service to regulate operations is limited by exemptions within the regulations. Under the 9B regulations, those operations accessed without crossing federal lands or waters are exempt from the "plan of operations" requirement of the regulations as are operations that existed before the lands were made part of a park. Such operations are essentially grandfathered. Unlike the access exemption, grandfathered operations can lose their exemption when their existing state or federal permits expire or new permits are required. This is often the case when operations change ownership. The "plan of operations" is the keystone to the 9B regulations. Through the plan, the NPS ensures that operators will use technologies least damaging to unit resources, provide for visitor safety, and will not significantly interfere with unit management.

The Division dedicates a significant portion of its minerals management staff to assist parks in reviewing plans of operations submitted by operators to determine if the plans meet all of the regulatory requirements and environmental protection goals. This year was no exception. The Division provided technical reviews of plans of operations for 20 seismic proposals, 12 new wells, and 3 plans for continuing existing operations. Collier Resources Company submitted 10 plans for seismic and drilling proposals in Big Cypress National Preserve in Florida. Each of Collier's plans of operations includes proposals for extensive 3D-seismic programs and from one to three exploration wells. In all, the area covered by the proposed seismic programs approaches 500,000 acres, including nearly 100,000 shot-hole points, 80 miles of new roads, and 35 acres of improved staging pads.

The proposal also includes a total of 28 exploration wells. If Collier conducted each proposed operation in succession, it would take over 30 years to complete all oil and gas exploration projects. Collier has taken an atypical approach in their permit applications compared to normal oil and gas industry exploration planning, perhaps leading to a proposal for a mineral rights buyout.

Also in Big Cypress, Calumet conducted a 16-square mile 3D-seismic survey over its producing Raccoon Point Field. The goal of the survey was to identify the potential for further development in the field. Although the company discussed the possibility of a new well location extending the field, no formal proposals have been submitted to the NPS to date. Division staff visited Big Cypress during the survey to witness a company doing its best to conduct operations in an environmentally sensitive manner. With the help of a vigilant park staff, the operator was largely successful in mitigating adverse impacts to park resources and values.

In Texas Big Thicket National Preserve and Padre Island National Seashore continue to be the focus of 3D-seismic exploration programs. Three-D seismic enables the operator to image the subsurface much more clearly than conventional seismic. If conventional seismic provides a "slice of the pie" then 3D-seismic provides the "whole enchilada." The land use requirements of 3D surveys, and thus the impacts, are proportional to the increased imaging abilities. Both Big Thicket and Padre Island have had, or have received, proposals to conduct 3D-seismic surveys over the entire units. In Big Thicket at least one new well has been drilled based on the recently acquired 3D seismic information, and a half dozen more are in the works. Most of those wells are planned to be

directionally drilled from surface locations outside of Big Thicket. At Padre Island, an operator has proposed a well to test deep horizons based on the newly acquired seismic data.

One notable issue during 1999 was a 3D seismic proposal from a company wanting to survey portions of submerged lands in Gulf Islands National Seashore off the coast of Mississippi. The proposal led park and Division staff to review the deed conveying barrier islands and adjacent submerged lands from the State of Mississippi to the United States. To our surprise, and contrary to earlier belief, the United States acquired the mineral estate when it acquired the property. Mississippi had actually issued a permit to explore submerged lands in the park under the mistaken impression that the state had retained oil and gas rights. The NPS simply said "No" to the proposed operations. Current law prohibits exploration and development of federal minerals in National Park System units unless a park's enabling legislation expressly provides for it.

Another major emphasis for the Division over the past two years has been nonfederal oil and gas management planning for three Texas parks - Lake Meredith National Recreation Area, Big Thicket, and Padre Island (see related article).

Oil and gas prices began to rise in the second half of 1999 and continued to climb in 2000. If prices hold firm, there likely will be more plans of operations, more seismic activity, and more drilling and production operations in parks.

Nonfederal Oil and Gas Operations Summary

Park	State	Total Number of Operations	Regulated Operations	Unregulated Operations *
Alibates Flint Quarries NM	TX	1	0	1
Aztec Ruins NM	NM	3	0	3
Big Cypress Npres	FL	25	25	0
Big Thicket Npres	TX	27	24	3
Big South Fork NR & NRA	TN, KY	314	0	314
Cuyahoga Valley NRA	OH	95	6	89
Gauly River NRA	WV	18	0	18
Lake Meredith NRA	TX	172	123	49
New River Gorge NR	WV	2	0	2
Obed WSR	TN	4	0	4
Padre Island NS	TX	6	6	0
Tallgrass Prairie Npres	KS	25	0	25
Totals		692	184	508

"Swap in the Swamp" for Big Cypress Mineral Owners Falls Through

In the last annual report, the Division reported that Collier Resources Company, the majority mineral owner in the Big Cypress National Preserve, was inundating Big Cypress National Preserve with proposed oil and gas development plans of operations. The company continued its efforts during 1999 and 2000 by revising and augmenting many of its 24 plans. While Collier has been planning exploration and development, it has also been trying to broker an exchange involving their mineral rights in Big Cypress for other federal properties. Mostly, the targets have been closed military installations. Last year, Collier focussed on the decommissioned Homestead Air Force Base located about 30 miles south of Miami between Everglades National Park and Biscayne National Park. Initially, the base was slated for redevelopment as a commercial airport, a plan not supported by the NPS due largely to potential noise issues. One of the alternatives in the environmental impact statement prepared by the Air Force for disposal of the base was to transfer the property to the Department of the Interior to use in an exchange for minerals in Big Cypress. Ultimately, the Air Force disposed of the property to Miami-Dade County for use as residential and light industry development. Now Collier has returned their attention to oil and gas development in Big Cypress.

Oil and Gas Management Workshop at Cuyahoga Valley a Success

The Division provides park staff with the training related to the management of nonfederal oil and gas operations in parks. The schedule for training varies with turnover of park staff responsible for managing oil and gas and with changes in issues facing them. Typically, the Division will host formal,



Oil and Gas Management Workshop at Cuyahoga Valley NRA, Ohio.

Service-wide oil and gas development training every 2 to 3 years. Last fall Division staff held a comprehensive nonfederal oil and gas management training course at Cuyahoga Valley National Recreation Area. Nearly all parks managing nonfederal oil and gas sent key staff to participate. The course ran for three full days - two days of class and one afternoon in the field visiting operation sites. The workshop moved away from a lecture format to more informal presentations that encouraged discussion of key issues. Overall, feedback from the participants was very positive. ◆

Petroleum Storage Facility near Petrified Forest National Park Assessed

The Division evaluated issues related to the Ferrell Liquefied Petroleum Gas Storage Facility adjacent to Petrified Forest National Park. The facility is less than a mile from the park boundary and provides storage of up to 84 million gallons of butane and propane using 11 salt cavern storage wells. The Division found that a catastrophic spill event at the Ferrell Storage Facility would not likely impact park resources other than short-term air quality degradation. However, a major spill event or fire might require evacuation and closure of the park road east of the Storage Facility to minimize the potential for injury to park employees and visitors. Therefore, the Division recommended that the superintendent petition Ferrell Gas Company to be placed on the emergency notification list for large spills and fire incidences. The assessment also provided information to the park for use in its General Management Plan revision, Resource Management Plan, Safety Plan, and Emergency Operations Plan.

Cuyahoga Valley Plugs Another Oil and Gas Well as Part of a Land Acquisition Deal

Cuyahoga Valley National Recreation Area has set an example for land acquisition. A recently acquired piece of property included an orphaned oil and gas well. The park negotiated funds for plugging the well as part of the acquisition. The park used plugging specifications from prior year's plugging projects to negotiate a contract with a service provider experienced in Cuyahoga Valley. Plugging operations are now complete and surface restoration is in progress.

Assessment of Contamination at Oil and Gas Sites

By Lisa Norby, Petroleum Geologist and Pat O'Dell, Petroleum Engineer

The United States Geological Survey (USGS) has developed simple and cost-effective techniques to assess contamination at oil and gas sites. During the past several years, Division staff and



Chloride titration strips, used to measure salt in soil and water samples at oil and gas sites.

USGS researchers tested these techniques at Big South Fork National River and Recreation Area and Padre Island National Seashore. The techniques use portable equipment to rapidly evaluate oil and gas exploration and production sites for contamination with hydrocarbons, produced water salts, and naturally occurring radioactive materials (NORM). The techniques provide semi-quantitative data that can be used to compare and prioritize sites for more formal site assessment efforts and remediation or to assess the effectiveness of past remediation activities.

In the process of testing the equipment, the parks were able to gain some insight into contamination at a number of oil and gas sites without the need for more expensive laboratory analysis. Over the course of several days, the USGS visited seven sites in and around Big South Fork and detected contamination at several of these sites. Two of the sites were areas of past hydrocarbon remediation projects. Cleanup of hydrocarbons at the two sites seems to have been successful, but there is evidence that the contamination has moved beyond the area of reclamation. At Padre Island National Seashore, three sites were selected for reconnaissance testing. Hydrocarbon contamination was found at all three sites, even though two of the sites had undergone remediation. The field inspections are helpful in pinpointing areas in the park where remedial work will be needed in the future.

Hydrocarbon leaks and spills may stain soils, or be visible as oil in pools on the surface, in pits, or as oily sheens on the surface of ponds and streams. Subsurface hydrocarbons may not be obvious where they are dissolved in groundwater or are moving as a separate phase on the surface of the water table. Field investigators can test sites for hydrocarbon contamination using a photoionization detector (PID). The PID can detect volatile organic carbon (VOCs) in soils and groundwater. Measuring VOCs in the gases from an augered hole, soil sample or groundwater sample, allows the mapping of hydrocarbon migration in the shallow subsurface of an oil and gas site. This simple approach provides instantaneous readings with excellent sensitivity and range (0.1 to 10,000 part per million VOCs). Knowledge of the production and spill history of the site, local geology, and the depth to the water table is essential for a good site assessment.

Water commonly produced at oil and gas production sites have salinities ranging from several thousand to 400,000 parts per million (ppm) chlorides. Produced waters (brine) can spill on a production site if there is a leaking storage tank, rupture of a pipeline, or an unlined or leaking production pit. It is possible that sodium (Na), chloride (Cl), and sulfate (SO₄) concentrations may exceed national drinking water standards, or standards for irrigation and livestock use and could damage soils and vegetation, and harm or kill fish and wildlife. Produced waters may also contain trace amounts of toxic elements. A field conductivity meter measures the concentration of salts in water and soil samples. Chloride titration strips can also be used to measure chloride concentrations in water and soil leachates. A simple sampling program for chloride concentrations can identify whether offsite migration of produced waters is a problem.

The Environmental Protection Agency estimates that about one-third of the oil and gas sites in the United States have radioactivity (NORM) levels high enough to be of regulatory concern. The common types of oilfield NORM contamination are radium and radon. Radium is associated with water



A micro-resistivity meter (microRmeter), used to measure naturally occurring radioactive materials (NORM) that may be present at oil and gas sites.

produced with oil and gas as dissolve radium salts. As pressures and temperatures drop, radium may precipitate out of the solution and concentrate in tanks, vessels, pipes, sludge pits, and other equipment. Past practices of cleaning equipment on-site and of storing produced water in production pits have also resulted in NORM contamination in soils. Radon is commonly produced with natural gas, with high concentrations reported in the United States and Canada. Radioactive films form on gas transportation and processing equipment. Gas processing which removes lighter natural gas liquids (NGLs) also removes the radon gas. Radon is concentrated in the lighter NGLs and in processing equipment associated with their production, treating, and transportation.

Health hazards from NORM do not occur from casual exposure. The radioactive materials are not health hazards unless persons are directly exposed to gamma radiation or NORM is ingested or inhaled. If inhaled, the dust and aerosols containing NORM can attach to the lung surfaces, where they emit alpha radiation into the tissue of the lung lining. The decay products of NORM will remain in the body over a lifetime and the effects of repeated exposure is cumulative. In addition to complying with regulatory requirements for NORM disposal, it is absolutely necessary that persons working with NORM contaminated equipment and soils use special handling procedures and good hygiene practices to prevent inhalation and ingestion. A microRmeter detects the presence of gamma rays, which is an indicator of NORM in equipment and soils. By comparing microRmeter readings to background levels one can assess whether NORM contamination exists at an oil and gas site. ◆

Validity Assistance to Mojave National Preserve

The Division completed validity work on unpatented claim groups in Mojave National Preserve. GRD mineral examiners completed mineral reports on the Golden Quail group and the Volco group. The Golden Quail mineral examination involved 16 unpatented lode mining claims (298 acres total) where the company proposed development of a 1,300-foot open pit mine and milling operation to extract gold. The Volco exam involved the proposed extraction of a variety of commodities, including gold, from 9 lode and 1 placer mining claim. Certified mineral examiners in the Division conducted fieldwork for these exams in 1997 and 1998. The two separate reports concluded that each claim group lacked sufficient mineralization to develop paying mining operations, and recommended that BLM declare the claims null and void for lack of discovery. Final decisions on the validity of these claims are forthcoming.



Certified Mineral Examiner cutting a channel sample in a prospect trench on the Golden Quail lode mining claims. (Mojave National Preserve, California) In February 2000, the Bureau of Land Management approved the NPS mineral report that challenged the validity of all 16 Golden Quail claims (298 acres) where the company had proposed a 1,300-foot diameter open pit mine and milling operation.

Mining Claim Validity

By John Burghardt, Geologist / Certified Mineral Examiner

At the close of 2000, there were 1,086 unpatented mining claims within 11 units of the National Park System. New mining claims cannot be located on park lands since these lands have been withdrawn from mineral entry. However, existing mining claims on federal lands that are subsequently withdrawn from mineral entry and added to the National Park System retain their full status under the law.

One who locates (stakes) a mining claim under the General Mining Law of 1872 is known as a "claimant." By locating a mining claim, the claimant asserts that he or she has discovered a valuable (economic) mineral deposit. If the assertion is true then the claim is "valid." The process of verifying that claimants have a valid claim is called a validity examination. The Bureau of Land Management (BLM) is the lead agency within the Department of Interior responsible for validity examinations and the administration of the Mining Law. The NPS has conducted validity exams on unpatented mining claims in parks under an interagency agreement with BLM since the 1970s. The NPS initiates validity examinations when claimants submit proposed plans to develop unpatented mining claims. Validity exams may also be initiated to clear title to land.

The first step of the validity process requires a determination of whether the subject claims have been filed, recorded, and maintained in full compliance with the law. Once this is confirmed, a certified mineral examiner conducts the field examination. The examiner, who has education and experience in geology, mining engineering, metallurgy, mineral economics, and mining law, reviews and verifies, if possible, any exploration or production data submitted by the claimant. The examiner samples each claim to confirm the quantity and quality of mineralization present and then prepares an exhaustive mineral report summarizing the findings. BLM reviews and approves the report for technical adequacy.

Claimants with valid claims may be permitted to mine upon approval of a complete plan of operations meeting the regulatory requirements of 36 CFR 9A and compliance with various other federal and state permitting requirements, including the posting of an adequate bond. In cases where

environmental impacts cannot be sufficiently mitigated to protect park resources, the federal government may elect to purchase the claims at fair market value. If the mineral examiner determines that the claims are invalid, then BLM adjudicators issue the appropriate decision, nullifying the claims. This decision and underlying finding of invalidity are subject to appeal by the claimants. By challenging invalid



Abandoned miner's cabin on undeveloped Virginia City #1 lode mining claim, with view of Mount McKinley (elevation 20,219 feet) 30 miles to the south. (Denali National Park and Preserve, Alaska) The government uses the validity process to challenge such claims where valid existing rights under the Mining Law of 1872 have not been established. The process results in protection of park resources and values from incompatible uses.

claims and purchasing those with valid existing rights that threaten park resources and values, the NPS fulfills its statutory mandate under the Organic Act to manage parks in a manner that leaves them "unimpaired for the enjoyment of future generations." (16 USC §1).

Pertinent Issues

Several legal and policy issues were raised relative to mining claim validity in 1999 and 2000, affecting validity and mineral patent cases on Park Service land.

- The Solicitor interpreted the General Mining Law of 1872 to limit millsite patents to one millsite per patented mining claim.
- BLM issued a uniform procedure to account for non-historic trends for commodity prices used in validity and mineral patent examinations, considering both historic and futures markets. This action was largely prompted by a 30% drop in gold price from 1996-1999.
- The BLM adopted the position in November 2000, that patents are to be restricted to the minerals only, rather than conveying title to the surface, if a complete patent application was not received by the BLM prior to withdrawal from mineral entry.

- A decision by the 9th Circuit Court of Appeals in 1999 stated that claimants who prevail against the government in mining claim contest may be able to recoup fees under the Equal Access to Justice Act (EAJA). This decision underscores the need for mineral reports to be as complete and defensible as possible.
- The General Accounting Office (GAO) criticized the NPS for not recovering the costs of validity examinations from claimants, reasoning that the benefits of mining plan approval go directly to the individual claimants and mine operators rather than to the general public. The BLM proposed cost recovery regulations in the Federal Register in Fall 2000. The Division coordinated NPS formal comments on the rule, and leads the effort to have BLM include the NPS in its final regulation. ◆

Validity Assistance to Denali National Park and Preserve

Staff from the Division, the Alaska Support Office (AKSO), and the Alaska Regional Solicitors Office participated in a hearing in December 1998, on the Comstock, Eldorado, and Eureka lode mining claims in Denali. Nine unpatented lode claims had been located for precious and base metals in the 1960s before this area, part of the Kantishna Mining District, was included in the park. Two reports produced by AKSO staff and one report produced by GRD staff challenged all 9 claims on the basis that mineralization was insufficient to offset the cost of a mining operation. The Administrative Law Judge upheld the government's case and declared all 9 claims null and void for lack of discovery. The claimant's appeal of this decision to the Interior Board of Land Appeals is currently under review.

Division staff provided field assistance to the AKSO in August 1999, for a mineral examination of the Pass and Banjo lode mining claims, also in the Kantishna Mining District of Denali. Division staff reviewed a draft report prepared by the AKSO. Revisions to this report will be completed in 2001.



Historic Bunnell Mine on Comstock #2 lode mining claim. During 1999 the Department successfully challenged the four Comstock claims (68 acres total) and two other Denali mining claim groups in validity hearings.

Red Dog Mine, Cape Krusenstern National Monument

By Mark Ziegenbein, Geologist

The Red Dog Mine, the world's largest producer of zinc, is located on native corporation land between Cape Krusenstern National Monument and Noatak National Preserve, Alaska.

The mine operator, Cominco, mines, processes, and trucks over 1.4 million tons of lead and zinc concentrates to the port facility year-round each year. The concentrates are then transferred to 32,000 to 80,000 ton container ships during the 100-day, ice-free shipping season in the Chukchi Sea. The 54-mile long haul road passes through 24 miles of Cape Krusenstern in a transportation easement created by Congress.

Cominco's proposal for a 40% production expansion at the Red Dog Mine has heightened NPS sensitivity to resource impacts and to the Park Service's responsibilities to protect the park from activities related to mining, milling and ore transport through Cape Krusenstern. In 1999 and 2000, the Division assisted the Monument by:

- Compiling a review of the current (1991) Transportation System Operating Plan. Other offices contributing to the review include the NPS Water Resources Division, Air Resources Division, Environmental Quality Division, Alaska Regional Office, Alaska Support Office, and the Monument; the United States Geological Survey Biological Resources Division, and, the Environmental Protection Agency;
- Identifying areas of the plan that need revision or updating; and,
- Preparing a draft letter for the park to ultimately send to Cominco to request revisions in the operating plan.

The primary issues associated with activities on the haul road corridor include: updating the road maintenance operating procedures to assure protection of the natural and cultural resources of the Monument; developing restoration plans for the four gravel pits in the Monument; cleanup of spilled lead-zinc concentrate and other contaminants along with adoption of spill prevention measures; providing a comprehensive approach to the protection of cultural resources; protection of air quality; and, updating the caribou monitoring plan.

At the park's request, the Division is preparing a Red Dog Mine Transportation System procedures manual in order to assist park staff with future plan review, ongoing monitoring, inspection and enforcement. ◆



Delong Mountain Port Facility - Over 1.4 million tons of lead and zinc concentrates, 36,000 tons of fuel, and 17,000 tons of chemical reagents, food, equipment and supplies pass through the port facility (and the Monument) each year.



Red Dog Mill and Employee Residence - Jim Kulas, Environmental Manager at the Red Dog Mine, explains water quality monitoring at the lead/zinc floatation mill.

Sand, Rock, and Gravel Website: Tools and Information for Park Resource Managers

By Mark Ziegenbein, Geologist

All park units need sand, rock and gravel for maintenance and construction projects. At last count, the NPS was responsible for maintaining at least 16,000 buildings, 8,000 miles of road, 1,500 bridges and tunnels, over 400 dams, 5,000 housing units, 1,500 water or wastewater systems, 300 fueling facilities, more than 200 solid waste operations and 2,000 fuel storage tanks. The NPS requires sand, rock, clay, or gravel to build and maintain the facilities. Most parks acquire their sand and gravel outside park boundaries. However, over 1,158 extraction sites, encompassing 7,510 acres exist in more than 100 units of the National Park System. At present, the NPS extracts material at 127 sites in 30 parks. Operations at another 315 sites in 49 parks are temporarily inactive, but available for future extraction. In addition, more than 562 park extraction sites need some form of restoration. To date, the NPS has reclaimed 154 extraction sites in parks.

The NPS 2001 Management Policies and NPS Special Directive 91-6 (NPS, 1991) as well as the draft Reference Manual 77 urge parks with active extraction sites to have a mineral materials extraction and reclamation plan with supporting environmental compliance documentation. At present, only 9 of these sites in 3 parks have such a plan and adequate NEPA analysis.

The Division has developed an intranet website that presents an overview of the legal requirements pertaining to internal extraction, recommendations for extraction site planning and reclamation, and mitigation measures to reduce adverse environmental impacts associated with NPS extraction operations. The website, which is periodically updated and refined, may be found at: http://www2.nrintra.nps.gov/grd/min_materials.

The "Sand, Rock, and Gravel" website contains:

- Examples and templates
- Completed NPS sand, rock and gravel plans and Environmental Assessments
- Example requests for Division assistance
- Site inventory sheets
- Example site maps and reclamation plans
- Applicable laws, policies and guidance
- Step-by-step planning guidance
- A handbook for reclamation cost estimation
- A restoration handbook
- Articles about past and present sand, rock and gravel planning efforts
- Links to selected websites with related information. ◆

http://www2.nrintra.nps.gov/grd/min_materials/

Dickerson Pit Mine Plan, Curecanti National Recreation Area

By Mark Ziegenbein, Geologist

Division staff assisted Curecanti National Recreation Area evaluate a proposed 22-acre quarry expansion within the recreation area. The Gunnison Gravel Company, a local contractor, has been extracting decomposed granite, volcanic breccia, and granite from the quarry since at least 1984, under previous NPS Special Use Permits. The land where the quarry is located is a split estate, that is, private mineral estate (subsurface) and Federal surface. The Colorado State Road Department, Gunnison County, the Bureau of Land Management, Colorado State Fish and Game, nearby residents, and

Curecanti all use these materials, primarily for road construction and maintenance.

Owners of private minerals in units of the National Park System continue to have that right to extract those minerals until the government purchases the right. However, the NPS has the authority to control how the operations are conducted in order to protect park resources and values and visitors. The operator originally contested Curecanti's authority to require a permit to mine, but eventually submitted a Special Use Permit application and mining plan of operations for review and approval. In 2000, the operator proposed to expand operations beyond the present 9-acre permit area to cover a total of 33 acres. The original expansion proposal would have created a 200-foot high (maximum) by 1,200-foot long granite highwall at a 0.5:1 (horizontal to vertical ratio) slope. Issues associated with the proposal include: visual impacts,

How the National Park Service regulates nonfederal mineral operations other than oil and gas in parks

After years of operating the gravel quarry in Curecanti National Recreation Area under NPS Special Use Permits, the quarry operator unexpectedly questioned NPS authority to regulate. He contended that the Service's regulations

Part 5, as business operations. When carried out on park lands that are either federally-owned or are administered by the NPS pursuant to a written agreement, such operations are subject to a Special Use Permit. The stipulations attached to a permit are extremely important, because they must protect park resources and public safety and ensure compliance with all applicable laws, regulations and policies (36 C.F.R. § 1.6). Furthermore,

as is the case with all proposed mining activities in park units, the NPS may not approve a nonfederal mineral operation if the operation would impair park resources and values (NPS Management Policies § 1.4.7). The letter also noted that NPS regulations and policies apply to the quarry in Curecanti because the owner's deed does not expressly exempt the operation from regulation. Further, the deed was executed in light of a law directing the Secretary of the Interior to conserve the lands that would become the National Recreation Area.



at 36 C.F.R. Part 9 are inapplicable to his operation, and that the deed reserving (maintaining) the nonfederal mineral right prevents the NPS from regulating the operation. In response, the Division drafted two letters to the quarry operator on behalf of the park.

The first letter explained that the Service does have the authority to regulate the operation. Nonfederal mineral operations other than oil and gas conducted in parks are regulated not under 36 C.F.R. Part 9, but under 36 C.F.R.

The second letter described the new Special Use Permit requirements set forth in Director's Order/Reference Manual # 53. For example, the park asked the operator to submit a detailed written explanation of his expansion proposal. The letter also explained the new standards of permit approval.

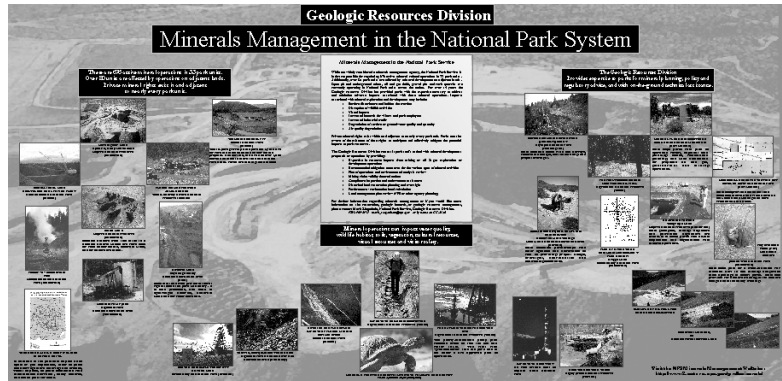
Subsequently, the operator abandoned his arguments that the NPS lacked legal authority to regulate his operation and submitted a written proposal to the park.

removal of cultural resources in the mine area, erosion and sedimentation of surface waters, habitat removal and wildlife impacts, potential for spilling fuel and other contaminating substances, dust, noise, public hazards due to heavy equipment operation, truck traffic, and blasting. The extraction area is within 500 feet of U.S. Highway 50 and is easily seen by travelers entering the N.R.A.

The Division assisted Curecanti by reviewing the mine plan, recommending modifications and mitigation measures, calculating the reclamation bond amount, meeting with the operator on-site to negotiate plan modifications, and crafting permit stipulations. In the final permit, the operator agreed to reduce the proposed expansion from 33 total acres to 11½ total acres (an expansion of 2 ½ acres) and change the final slopes from 0.5:1 to 2:1. He also agreed to revegetate the area with native species. The Special Use Permit included operating standards and mitigation methods needed to reduce visual, water, air, plant, animal, and cultural resource impacts as well as methods to reduce potential health and safety hazards. We are continuing to work with Curecanti to develop easy and effective methods for their staff to inspect the ongoing operation and assure compliance with the permit. ◆

Poster on the Road - Minerals Management in the National Park Service

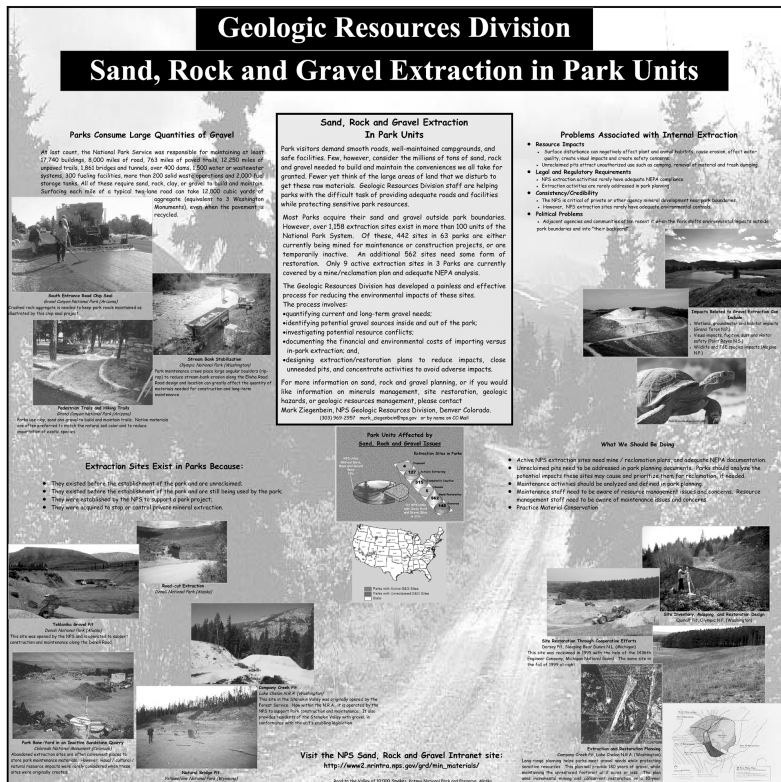
While not widely considered a minerals management agency, the NPS is in fact responsible for regulating 676 active mineral-related operations in 33 park units. Additionally, over 80 park units are affected by mineral development on adjacent lands. Open pit and underground mines, oil and gas fields, gravel pits and rock quarries are currently operating in park units across the nation. For over 15 years the Geologic Resources Division (and its predecessor organizations) has provided parks with the expertise necessary to address and minimize adverse impacts associated with these mineral operations.



The Division has created a 3'x 6' color poster to raise awareness of in-park mineral operation impacts/issues and to illustrate management techniques used to reduce resource impacts. This poster is available for your use upon request. For more information please contact Mark Ziegenbein (303.969.2957 - mark_ziegenbein@nps.gov - or by name on CC:Mail).

Poster on the Road - Sand, Rock and Gravel Extraction in Nps Units

Division staff are helping parks with the difficult task of identifying and using proper sources of raw materials for adequate roads and facilities in parks while at the same time protecting sensitive park resources. The Division has developed an effective process for reducing the environmental impacts of these sites and complying with NPS policy.

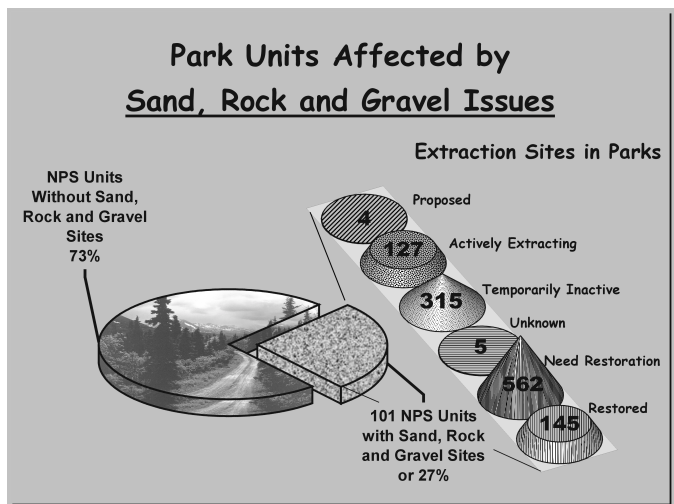


To raise awareness of in-park sand, rock and gravel issues and the available solutions to these management issues, the Division has developed an informative 4'x4' color poster. The poster is available for your use upon request. For more information please contact Mark Ziegenbein (303.969.2957 - mark_ziegenbein@nps.gov - or by name on CC:Mail).

Sand, Rock and Gravel extraction sites existing in Park units today:

- A total of 1,158 extraction sites, totaling 7,510 acres, exist in 100 units of the National Park System;
- All 7 National Park Regions have extraction sites;
- 30 Parks are currently mining 127 of these sites for maintenance or construction projects;
- 315 sites in 49 parks are temporarily inactive but available for future extraction;
- An additional 562 sites need some form of restoration. ♦

Park Units Affected by Sand, Rock and Gravel Issues



Assistance Provided to Regions, Parks, and Other NPS Organizational Units

Alaska Region

Regional Office

- Reviewed three declarations for the Director regarding the review of plans of operations under the 36 CFR 9A regulations; declarations were used in 3 different takings lawsuits associated with mining claims.
- Resource Management - Researched literature on Alaska paleontological studies and publications in preparation of all the paleontological surveys to be done in the region's NPS units (2 positions).

Aniakchak National Monument and Preserve

- Geologist-in-the-Parks, Resource Management - Explained geology to visitors.

Cape Krusenstern National Monument

- Reviewed historical documents and the existing Red Dog Transportation System Operating Plan; met with park staff and Cominco staff on-site, making recommendations on a course of action for management and monitoring of the corridor.

Denali National Park and Preserve

- Reviewed mineral appraisal of the Glacier Association #1-5 and Glacier Bench unpatented mining claims and provided comments to the Regional Lands Office; claims are targeted for acquisition.
- Completed technical review of mineral appraisal for Alder #1-4 mining claims for the Regional Lands Office.
- Provided technical review of the contracted third party appraisal for the Little Audrey #1-4 mining claims.
- Reviewed and provided comments on the mineral appraisal for Yellow Pup #1, 2, & 4 mining claims for the Regional Lands Office.
- Assisted in the initial organization of a park-wide Gravel Acquisition Plan; assisted in development of the associated Project Agreement and Statement of Work.
- Geologist-in-the-Parks, Resource Management - Inventoried and organized geologic specimens; developed geology interpretation exhibits.
- Geologist-in-the-Parks, Resource Management - Transferred map and database paleontological data to GIS database; sampled placer mines; inventoried fossil specimens.

- Provided field assistance and reviewed report prepared for Pass and Banjo lode claim validity examination.

Glacier Bay National Park and Preserve

- Geologist-in-the-Parks, Resource Management - Developed digital bedrock geology map; provided detailed descriptions of geology and geochronology.

Katmai National Park and Preserve

- Identified restoration measures needed to recontour, stabilize and revegetate an extraction area developed by the park to support reconstruction of the Valley of 10,000 Smokes Road.
- Geologist-in-the-Parks, Resource Management - Provided field assistance for geologic mapping.

Wrangell-St Elias National Park and Preserve

- Assisted with sand, rock and gravel extraction planning and potential gravel source study.
- Provided a technical review for mineral appraisal of copper mining claims, Tracts 28-118 & 119.
- Completed technical review of mineral appraisal for the Rex Creek mining claims, Tract 31-105.
- Completed technical review of mineral appraisal for the Mother Lode mining claims.
- Completed technical review of mineral appraisal for the Gold King mining claims.
- Provided comments for mineral appraisal on Big Eldorado mining claims.

Intermountain Region

Regional Office

- IMR Natural Resource Conference - Presented and led discussions on: Paleontological Resource Management, including an overview of the extent of these resources; regional paleontological issues; ongoing and proposed paleontological surveys of the parks; and, recent training of law enforcement rangers to address fossil theft.

Arches National Park

- Verified that park map of the expanded boundaries is the "official" map.
- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.
- Provided slides to park interpreter for new geology program for visitors.

- Provided state contact for inquiry on potassium leases.

Aztec Ruins National Monument

- Analyzed purchase and sale agreement between the U.S. and private land owner; coordinated comments with Santa Fe Field Solicitor.
- Researched current production and future oil and gas potential made recommendation regarding future oil and gas development potential and acquisition of the nonfederal mineral rights.

Bandelier National Monument

- Coordinated with the Natural Resources Conservation Service (NRCS) the initiation of a soil survey addressing various local soil resource concerns.
- Geologist-in-the-Parks, Research - Characterized potential subterranean pathways for contaminant transport from external lands.

Badlands National Park

- Provided legal information, including case law and Solicitors opinions, to a U.S. Attorney working on a sand and gravel ownership issue.
- Geologist-in-the-Parks, Resource Management - Prepared and presented fossil talks; provided on-site dig talks.
- Geologist-in-the-Parks, Interpretation - Provided interpretive talks; assisted in fossil excavation and curation.

Big Bend National Park

- Provided a mineral appraisal of the value of agate in a case involving the theft of agate from the park, to determine appropriate penalties.
- Assisted the park in the development of a park-wide disturbed land inventory and assessment program.
- Geologist-in-the-Parks, Resource Management - Initiated and continued paleontological surveys to help produce a map of paleontological sites.

Big Thicket National Preserve

- Performed technical evaluation of four proposed oil and gas plans of operations: Cobra Exploration Company 3D-seismic survey; Mariner Energy Blackstone Minerals "E" No. 2 and B-1 new well drills; Seismic Exchange Incorporated 3D-seismic survey; and, Merit Energy's plugging and reclamation of their Rafferty lease.

- Prepared a Reasonably Foreseeable Development Scenario for the remaining hydrocarbons underlying the Preserve based on USGS estimate of remaining reserves.

- Prepared pertinent chapters in the Oil and Gas Management Plan.

- Provided policy and regulatory guidance to park regarding issues of the park oil and gas management planning effort.

- Prepared letter for park Resource Management Specialist in response to Sierra Club concern over the park management of oil and gas operations.

- Prepared letter for park in response to Sierra Club concern over temporary approval for preliminary data gathering activities by Cobra, a 3-D seismic company.

- Assisted park in addressing two gas well operations that had run beyond the term of temporary approval.

- Assisted in resolving potential seasonal conflict between hunting activities and 3-D seismic activities; discussed issue with Field Solicitor on behalf of the park.

- Advised park on how to handle abandoned operation site, where erosion of river bank has exposed plugged well casing.

- Reviewed and provided suggestions for the public newsletter on the Oil & Gas Management Plan.

Bryce Canyon National Park

- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

- Geologist-in-the-Parks, Interpretation - Provided interpretive presentations and developed interpretive geology products.

Canyonlands National Park

- Drafted Notice of Termination of Metalliferous Lease No. 25364.

- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

- Provided technical assistance on old state metalliferous mining leases.

- Conducted radiological contaminants study in cooperation with Utah Division of Oil, Gas and Mining and USEPA using waste piles at Lathrop Canyon Mines as representative of typical uranium mine waste in the Colorado Plateau.

Capitol Reef National Park

- ▶ Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.
- ▶ Updated appraisal of mineral selenite for pending natural resource case involving theft and damage of selenite.
- ▶ Geologist-in-the-Parks, Resource Management - Developed and presented geology interpretive programs and produced interpretive materials; hosted and instructed children's geology day camp.
- ▶ Geologist-in-the-Parks, Instructor - Ran Junior Geologist program.

Capulin Volcano National Monument

- ▶ Continued participation in preparation of new park General Management Plan; serve as the geologic advocate on planning team.
- ▶ Geologist-in-the-Parks, Interpretation - Provided interpretive geology programs.
- ▶ Geologist-in-the-Parks, Interpretation - Led geology overview to AmeriCorps team and developed a brochure on the Clayton Volcanic Field.

Cedar Breaks National Monument

- ▶ Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

Curecanti National Recreational Area

- ▶ Assisted by negotiating with the mine operator, conducting mine plan review, developing mitigations, calculating reclamation costs, and developing permit stipulations for an in-park quarry expansion proposal.
- ▶ Drafted two letters on behalf of the park replying to the operator's questions about NPS regulatory authority over his operation and the process for obtaining a Special Use Permit.
- ▶ Mapped the Elk Creek Pumphouse site, developed restoration prescriptions, and provided cost estimates to demolish facilities and restore the access road and site.
- ▶ Resource Management, Interpretation - Assisted in drafting educational curriculum on park geology.
- ▶ Geologist-in-the-Parks, Interpretation - Provided interpretive programs and developed an education curriculum on park geology.

Devils Tower National Monument

- ▶ Drafted memorandum explaining NPS liability for visitor safety and the steps that the NPS can take to prevent losing these types of lawsuits in the future.
- ▶ Geologist-in-the-Parks, Interpretation - Conducted geology literature search; updated geology exhibits.

Dinosaur National Monument

- ▶ Provided a copy of the AML Field Inventory Report to park planning staff.
- ▶ Commented on the draft EIS for the Yankee Gulch Sodium Minerals Project adjacent to Dinosaur National Monument; proposal included full field development of injection and extraction wells to remove sodium from the Picance Creek Basin.
- ▶ Organized and participated in meeting with DINO staff and IMR staff to discuss strategies for protection park from an impending BOR decision to reduce water flows upstream from park.

Florissant Fossil Beds National Monument

- ▶ Facilitated and participated in workshop at the park addressing conflicting mapping interpretations.
- ▶ Geologist-in-the-Parks, Resource Management - Inventoried paleontological resources; curated fossils; assisted with park research projects.
- ▶ Geologist-in-the-Parks, Interpretation - Provided Interpretation of paleontological sites; assisted in fossil excavations.
- ▶ Coordinated cemetery adit closure.

Fort Bowie National Historic Site

- ▶ Provided engineering design, a technical report of the process, and supervision for two abandoned mine shaft closures using polyurethane foam.

Fossil Butte National Monument

- ▶ Advised park on opportunity to use Park Service Resource Protection Act (19jj) to recover damages for theft of paleontological resources.
- ▶ Geologist-in-the-Parks, Resource Management - Added to park paleontological inventory.
- ▶ Geologist-in-the-Parks, Interpretation - Continue development of the virtual paleontology site.
- ▶ Geologist-in-the-Parks, Resource Management - Excavated, documented, and curated fossils; performed fossil excavation, preparation and curation for "virtual fossil dig"

exhibit; summarized status of fossil theft, threat of theft, and protection methodologies.

Gila Cliff Dwellings National Monument

► Assisted retired USGS geologist on preparing text and graphics for an interpretive display on the evolution of the overhangs under which the dwellings were constructed.

Glen Canyon National Recreational Area

► Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

► Conducted pre-closure site inspections and made closure recommendations for Blue Notch, White Canyon, and Whirlwind mine sites in collaboration with Utah Division of Oil, Gas and Mining and Bat Conservation International.

Grand Canyon National Park

► Geologist-in-the-Parks, Interpretation - Audited seasonal geology interpretive programs; developed hands-on working model to demonstrate fluvial processes to visitors; provided interpretive programs.

► Geologist-in-the-Parks, Interpretation - Researched and developed draft interpretive training manual; provided interpretive presentations.

► Assisted in site characterization and CERCLA liability research for Orphan Uranium Mine.

Golden Spike National Historic Site

► Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

Great Sand Dunes National Monument

► Facilitated final USGS publication of Proceedings from 1995 Symposium on Aeolian Features

► Geologist-in-the-Parks, Interpretation - Developed geology pamphlet; provided interpretive geology programs.

► Geologist-in-the-Parks, Resource Management and Interpretation - Revised and created a number of geology handouts; provided interpretive programs; assisted with dune geomorphology and river hydrology research.

Guadalupe Mountains National Park

► Geologist-in-the-Parks, Resource Management - Provided geologic expertise and attended professional paleontological training to apply skills in park.

John D. Rockefeller, Jr. Memorial Parkway

► Continued assistance with the proposed restoration of the Snake Pit gravel extraction area.

Lake Meredith National Recreation Area

► Performed technical evaluation of plan of operations for Pantera Energy and Chesapeake Operating Company for continued operation of existing wells.

► Prepared a “Reasonably Foreseeable Development Scenario” for the remaining hydrocarbons underlying Lake Meredith/Alibates Flint Quarries. Scenario is based on USGS estimate of remaining reserves underlying the parks.

► Provided policy guidance for the internal scoping meeting on the Oil and Gas Management Plan; participated in scoping meeting and two alternatives meetings; prepared Chapter 2, Parts 1-3, updated Appendix C, and wrote Chapter 4; provided technical review and comments on the in-house and policy review drafts of the Plan and EIS.

► Determined that the Federal Advisory Committee Act was not a bar to the participation of the Canadian River Water Authority in an internal scoping meeting for the Oil and Gas Management Plan.

► Coordinated Colorado School of Mines student project to develop report entitled “Road Construction and Maintenance Standards for Oil and Gas Access Roads, Flowlines and Pipelines.”

► Advised park on how to respond to a request to issue a noncompetitive lease under the Texas Relinquishment Act; prepared briefing for Regional Director and coordinated with Santa Fe Field Solicitor.

Mesa Verde National Park

► Researched current oil and gas activity and future oil and gas potential; made recommendation regarding future oil and gas development potential and acquisition of the nonfederal mineral rights.

► Provided advice to park staff regarding sand, rock and gravel extraction planning and alternatives to in-park extraction.

► Geologist-in-the-Parks, Resource Management - Mapped bedrock geology.

Natural Bridges National Monument

► Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

Padre Island National Seashore

- ▶ Performed technical evaluation of plans of operations for: Western Geophysical’s Phase I, II and III Addendum 3D-seismic survey plan: Taurus Operation Company plan for continuing operations; and, Vector Energy plan for continuing operations.
- ▶ Performed preliminary evaluation of proposal by BNP to drill an exploration well testing deep gas potential.
- ▶ Responded to public comments on the Draft Oil and Gas Management Plan/ EIS draft Record of Decision, and condensed final Oil and Gas Management Plan; prepared text for both documents.
- ▶ Provided guidance to park regarding Louis Dreyfus Natural Gas Co. reclamation of abandoned oil and gas operation site at Yarborough Pass; assisted park to develop a strategy for addressing the violation of the cleanup operation.
- ▶ Drafted letter to Louis Dreyfus Natural Gas Co. requiring cleanup mercury and hydrocarbon contamination and reclamation of abandoned oil and gas operation site at Yarborough Pass.
- ▶ Provided guidance on oil and gas issues including: regulation of transpark pipelines; application of Part 6 regulations to oil and gas operations; options for cost reimbursement and use fees; compensation for resource damages; NPS authority to regulate oil and gas development; and, management of pipelines.
- ▶ Drafted a bond agreement between NPS and Western Geophysical, a 3-D seismic operator; coordinated effort with Field Solicitor in Santa Fe.
- ▶ Drafted indemnity agreement to be attached to Louis Dreyfus Natural Gas Corp’s approved plan through the 9B plan supplementation provision.
- ▶ Drafted letter responding to BNP Corporation regarding NPS authority to regulate nonfederal oil and gas operations in the park.
- ▶ Reviewed and revised draft letter requesting that Vector Energy take immediate corrective action to clean up oil contamination that resulted in the death of four migratory birds.

Petrified Forest National Park

- ▶ Conducted an assessment of environmental and safety issues related to the Ferrell liquified petroleum gas storage facility and provided a report.

Pipe Spring National Monument

- ▶ Provided mining engineering and advise on rock mechanics regarding the collapse of Tunnel Spring; reviewed draft Tunnel Spring design for Water Resources Division.

- ▶ Inspected collapsed adit; attended multidisciplinary task group meeting to propose possible mitigation plans.

Rainbow Bridge National Monument

- ▶ Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

Sand Creek (Proposed Area)

- ▶ Researched the oil and gas potential in the vicinity of the massacre site for inclusion in the Sand Creek Special Resource Study.

Saguaro National Park

- ▶ Provided a technical review of the Mining Hazmat Evaluation Report for 39.37 acres of Tract 01-171.
- ▶ Provided continuing and updated information regarding the Old Yuma Mine (Comet No.1 lode mining claim) patent application.
- ▶ Conducted site inspection and provided comments on Wildhorse Mine experimental bat gate closure.

Sunset Crater Volcano National Monument

- ▶ Geologist-in-the-Parks, Interpretation - Produced thin sections of the lava rocks and installed microscope center in visitor center; developed and conducted geology talks.
- ▶ Geologist-in-the-Parks, Education - Assisted with development of earth science materials.
- ▶ Reviewed and provided comments on the General Management Plan.

Timpanogos Cave National Monument

- ▶ Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.
- ▶ Geologist-in-the-Parks, Resource Management and Interpretation - Provided oversight of undergraduate work in developing geology training manuals; provided summary of area geology for training manual, wayside exhibit designs, and resource management issues.

Walnut Canyon National Monument

- ▶ Reviewed and provided comments on the Draft EIS/GMP.

Washita Battlefield National Historic Site

- ▶ Researched current oil and gas activity in the vicinity of the park and future oil and gas potential, prepared text for the General Management Plan describing the NPS regulatory authority and oil and gas potential.

- Prepared discussion of geology for GMP and for use in the interpretation of surficial geology.

Wupatki National Monument

- Reviewed and provided comments on the Draft EIS/GMP.

White Sands National Monument

- Facilitated technical assistance request on park research needs with USGS expert on aeolian processes.
- Geologist-in-the-Parks, Interpretation - Developed and conducted geology talks.

Yellowstone National Park

- Facilitated multi-agency conference call on status of digital geologic map coverage of park that ultimately led to production of the map.
- Partnered and facilitated work with USGS staff on the Yellowstone Technical Advisory Compact mapping proposal for lands adjacent to the park.
- Commented on planning documents and participated in technical meetings on Maxim Technologies' proposed SB-4B impoundment site as the final dumping site for contaminants recovered during the cleanup of the New World mining district.

Zion National Park

- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.
- Geologist-in-the-Parks, Resource Management - Developed and began paleontological survey.
- Geologist-in-the-Parks, Interpretation - Summarized and provided a report on the area geology; provided interpretive presentations.

Midwest Region

Agate Fossil Beds National Monument

- Geologist-in-the-Parks, Resource Management - Provided literature research and summary of research done at Stenomylus Quarry; developed and began populating paleontological database.

Buffalo National River

- Geologist-in-the-Parks, Resource Management - Mapped and surveyed caves; collected GPS locations; entered cave data into database.

Cuyahoga Valley National Recreational Area

- Assisted in developing a well plugging and reclamation agreement between NPS and Moore Well Services, Inc. for plugging of the Blossom #3 well.
- Inspected candidate wells for plugging and provided park with well-by-well plugging specification as part of developing a well-plugging bid.

Hot Springs National Park

- Coordinated the site visit of a rock mechanics specialist to inspect an unstable slope threatening the cooling tower for the historic bathes; reviewed report and obtained an engineering specialist to provide cost estimates to mitigate potential problem.

Ozark National Scenic Riverways

- Prepared draft memo for Director's signature requesting a withdrawal of federal minerals in the Mark Twain National Forest to protect park from external threat of lead mining.
- Reviewed documents withheld from FOIA disclosure pertaining to NPS opposition to lead mining in the Mark Twain NF; prepared statement for IMR FOIA officer to send to attorney for the Doe Run Company.
- Prepared responses for second and third FOIA requests from attorney representing the Doe Run Company.
- Attended technical meeting to assist park with research issues on the effects of lead mining in the Ozark Riverways region; prepared summary of studies presented at the tech team meeting.
- Provided WASO Solicitors Office with: documents and briefings regarding mineral withdrawal in the Mark Twain NF; provided documents discussing the possible segregation or withdrawal of NF lands; and, provided Solicitors Office with updated USGS maps and prepared summary describing the relevance of each.
- Briefed park on a rider to a Senate Appropriations bill for DOI affecting the authority of the Secretary to withdraw federal mineral interests in the Mark Twain NF.
- Geologist-in-the-Parks, Resource Management - Surveyed caves and springs; participated in field research on river deposition.
- Geologist-in-the-Parks, Interpretation - Provided interpretive presentations on the area's geology including the caves.
- Geologist-in-the-Parks, Resource Management - Researched literature on local geology; organized physical and digital data and updated database; updated cave inventory and monitoring protocols and data forms; collected missing GPS data.

Sleeping Bear Dunes National Lakeshore

- Geologist-in-the-Parks, Interpretation - Provided interpretive programs on park geology and interpretive programs on dune and beach geomorphology; revised geology theme bulletin boards; added to geology slides in park collection.

Tallgrass Prairie National Preserve

- Inspected all gas well operations and provided report documenting current condition of operations, identifying issues, and recommending appropriate courses of action.
- Drafted request for legal opinion from the regional Solicitor's office on the application of NPS regulations governing nonfederal oil and gas in the park.
- Participated in follow-up meeting with Regional Solicitor to discuss opinion regarding the effect of park enabling statute on application of NPS regulations in the park.
- Conducted review of oil and gas lease held by Knighton Oil Company to determine mineral interest owner when lease term expires; participated in meeting with park and NP Trust regarding the ownership of minerals once lease term expires.
- Provided mineral appraisal input into a possible buyout of oil and gas rights by NP Trust.

Theodore Roosevelt National Park

- Developed an abandoned mine land proposal to fund closing two subsided coal mine openings; supervised closing of the openings by park maintenance staff.

Voyageurs National Park

- Geologist-in-the-Parks, Resource Management - Synthesized geology literature; developed geology program recommendations; developed a geology guidebook and brochure.
- Provided geologic input to General Management Plan.

Northeast Region

Acadia National Park

- Supplied park with references and a written compilation of the mandates and guidance that apply to geologic research and specimen collection.
- Geologist-in-the-Park, Interpretation - Developed geology field trip program; expanded park geology classroom kits; conducted literature search on area geology and provided summary; provided geology training to staff; developed geology trail guide; provided interpretive programs.

Allegheny Portage Railroad NHS

- Review Acid Mine Drainage Plan for Staple Bend unit (coal drainage).

Assateague Island NS

- Geologist-in-the-Parks, Interpretation - Interpreted barrier island geology to visitors; compiled and edited barrier island and coastal geology information and past research for staff use.

Cape Cod National Seashore

- Geologist-in-the-Parks, Resource Management - Evaluated current scientific data on river system; presented related information to local public forums and officials.

Colonial National Historical Park

- Reviewed project proposal to stabilize erosion along James River, Powhatan Creek, Sandy Bay and Back River.

Delaware Water Gap National Recreational Area

- Geologist-in-the-Parks, Resource Management - Summarized current geological information regarding formation of the water gap; reviewed, critiqued and modified current geologic interpretive materials and wrote exhibit text.

Fire Island National Seashore

- Reviewed project proposal to rehabilitate Barrett Beach Marina and ferry terminal building.

George Washington Birthplace National Monument

- Assisted the park with taking steps to halt widespread and illegal fossil collections and to initiate a fossil evaluation program.

Green Springs Historic District

- Assessed the need for National Park Service to inspect Virginia Vermiculite's mining and reclamation activities in Green Springs National Historic District.

Jamestown National Historic Site

- Reviewed project proposal to stabilize eroding shoreline on Potomac River.

New River Gorge National River

- Reviewed mine plan and provided mining engineering and environmental consultation on proposed Glade Creek Underground Coal Mine.
- Coordinated the closing of 6 abandoned coal mine openings through the Office of Surface Mining.

- Prepared and submitted comments on a federal Office of Surface Mining draft *Oversight Report on Mountaintop Removal in the State of West Virginia*.
- Geologist-in-the-Parks, Resource Management - Identified status and quality of the park's existing geologic information; developed a geology bibliographic database.
- Provided scoping comments on EPA's environmental impact statement for mountain top coal removal in the Appalachian area.
- Commented on the West Virginia state permit application for the proposed Glade Creek #1 Deep Mine.
- Commented on state permit application from High Power Energy for coal mining in the Peters Creek drainage adjacent to park.

Pacific West Region

Regional Office

- Worked with California Desert Parks and BLM to determine status of unpatented mining claims in Death Valley, Joshua Tree, and Mojave.
- Researched applicability of California law to NPS mineral examiner contractors, confirming that state law applies to contractors.
- Reviewed Draft Memorandum of Understanding between the State of California and the three California Desert Parks applying exercise of private mineral rights in those parks.

Channel Islands National Park

- Provided advice to park staff regarding sand, rock and gravel extraction planning and alternatives to in-park extraction.

City of Rocks National Reserve

- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.
- Provided advice regarding sand, rock and gravel extraction planning and alternatives to in-park extraction.
- Geologist-in-the-Parks, Interpretation - Researched and developed a geologic site bulletin; developed interpretive programs.

Craters of the Moon National Monument

- Conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports.

- Geologist-in-the-Parks, Resource Management - Developed and enhanced cave inventory procedures; created cave resource database; gathered GPS data; consolidated available cave information.

Death Valley National Park

- Reviewed and provided comments on the Desert Manager Working Group's draft "annex" (guideline) for implementing Section 708 of the California Desert Protection Act.
- Assisted park with applying NPS regulations at 36 CFR Part 9A to mining operator seeking access through the park to mining claims on BLM lands.
- Conducted research symposium on status of geologic research in Death Valley; conducted scoping meeting as part of Geologic Resource Inventory to review coverage, availability, and quality of existing geologic maps and reports; participated in park research roundtable to review geologic research permitting process.
- Reviewed mineral appraisal for Rainbow Talc Mine.
- Helped park analyze proposal to use park road to access a mining operation outside the park.
- Provided advice to Support Office regarding sand, rock and gravel extraction planning and alternatives to in-park extraction.

- Geologist-in-the-Parks, Resource Management - Searched literature to delimitate avian fauna localities; created database of parks with taxa noted.

- Geologist-in-the-Parks, Resource Management - Developed and initiated paleontological survey of the park.

- Geologist-in-the-Parks, Resource Management and Interpretation - Provided oversight of research requests; summarized past research findings.

Hagerman Fossil Beds National Monument

- Geologist-in-the-Parks, Research - Sampled and provided lab analysis to determine age of volcanic ashes, providing insight to the age of the fossils.
- Geologist-in-the-Parks, interpretation - Interpreted fossil sites to visitors; obtained GPS locations for fossil sites; collected and curated fossils; entered data into database.

Joshua Tree National Park

- Assisted park in asking BLM to declare mining claims null and void.
- Worked with the BLM Solicitor on claimant appeal of BLM decision.

- ▶ Developed informal guidance for NPS staff and mineral examiner contractors pertaining to NPS reclamation requirements for unpatented mining claims.
- ▶ Drafted letter to mining claimant in response to claimant's request for a "separate right of access."
- ▶ Submitted comments to the Western Archeological Conservation Center on its draft "protocol" for conducting National Historic Preservation Act Section 106 compliance at abandoned mining areas; assisted park with comments and in identifying issues to be resolved for compliance to run smoothly.
- ▶ Assisted in redirecting the efforts of a contractor to conduct a new validity exam at the park.
- ▶ Provided comments to the park on the environmental assessment for proposed plan of operations for the 1st Class Miners Club to access their claims adjacent to the park by way of park roads.
- ▶ Conducted two winter field surveys with Bat Conservation International of AML sites slated for closure, and provided closure recommendations accordingly.

Lassen Volcanic National Park

- ▶ Assisted with restoration design, project planning and review of the environmental analysis for the Walker "O" geothermal well pad and road restoration project.
- ▶ Provided the park with a disturbed land restoration assessment covering 24 sites describing potential for resource impacts, recommendations for additional work or surveys, and conceptual restoration alternatives.

Mojave National Preserve

- ▶ Responded to NPCA FOIA request pertaining to Cima Cinder Mine; assisted in responding to letters from various environmental organizations; worked with the Office of the Solicitor to avert lawsuit by several environmental organizations; worked with San Bernardino County to develop administrative record; drafted letter responding to Notice of Trespass and drafted the decision affirming Notice of Trespass.
- ▶ Continued to advise park as to potential courses of action for initiating the process of reclamation at the Morningstar Mine and possible sale of mineral material from the Morningstar mining claims.
- ▶ Responded to park inquiry regarding access to inholdings in wilderness.
- ▶ Completed validity exam of the Volco mining claims, concluding that all 10 claims were null and void for the lack of a discovery of a valuable mineral deposit.

- ▶ Completed validity exam of the Golden Quail mining claims, concluding that all 16 claims are null and void for lack of discovery of a valuable mineral deposit.
- ▶ Provided example of KSOC's to park staff for new mining engineering position.
- ▶ Provided list of mineral appraisers to assist the appraisal of a property containing rights to mineral materials.
- ▶ Reviewed draft environmental assessment for validity examination program.
- ▶ Participated in Technical Proposal Evaluation Committee for validity examination contractor selection.

Mount Rainier National Park

- ▶ Geologist-in-the-Parks, Resource Management and Interpretation - Developed and presented 4 different interpretive talks on park geology.

North Cascades National Park

- ▶ Assisted in obtaining a complete plan of operations, reviewed plan for completeness, prepared Federal Register Notice, and developed EA.
- ▶ Geologist-in-the-Parks, Resource Management and Interpretation - Developed ideas and obtained materials for 3 interpretive discovery drawers for visitor exploration; wrote interpretive geology brochures.

Olympic National Park

- ▶ Assisted in review of the Little River Quarry mining proposal adjacent to the park; provided park with analysis of potential impacts and suggested mitigation measures for the proposed operation.
- ▶ Assisted with sand, rock and gravel extraction planning for the Finley Creek Bridge extraction proposal.
- ▶ Reviewed and provided comments on proposed mineral exploration plan of operation at Shi Shi Beach.
- ▶ Participated in a joint meeting concerning the possible acquisition of mineral rights at Shi Shi Beach with region, park, and private owners to resolve potential problems.
- ▶ Coordinated beach sand sample analysis with USGS Denver Federal Center research laboratory.
- ▶ Provided engineering advice on potential removal of sand and gravel near bridge structure and environmental analysis recommendations.

Oregon Cave National Monument

- Geologist-in-the-Parks, Resource Management and Interpretation - Provided interpretive presentations on park geology; assisted in geology and hydrology research.
- Geologist-in-the-Parks, Resource Management and Interpretation - Provided interpretive presentations on park geology; assisted in dye tracing to determine hydrology of cave; studied solubility of the calcite in the cave; rewrote and made corrections to interpreters handbook to the cave.

Pinnacles National Monument

- Provided technical input to park on mitigation of unwanted "night light."
- Provided park geologist with information about compliance requirements for a proposed landfill reclamation project.

Point Reyes National Seashore

- Assisted with sand, rock and gravel extraction planning and restoration design on 15 disturbed sites.
- Assisted in the preparation of a proposal for funding of the Glenbrook Creek Dam restoration project.
- Provided technical review of an Army Corp of Engineers proposal regarding disposal of dredged materials from the Bolinas Lagoon in quarry areas in the park.

Redwood National and State Parks

- Reviewed draft tsunami plan and suggested revisions to reduce the potential for unnecessary NPS liability.
- Geologist-in-the-Parks, Resource Management and Interpretation - Assisted with river channel monitoring; provided geology liaison to park interpretive staff; explained beach geomorphology, dunes, seismicity, and tsunamis.

Yosemite National Park

- Worked with the park and with Denver Service Center staff to edit new Valley Plan (an amendment to the park's GMP) to ensure that the Plan will not trigger undue NPS tort liability.
- Reviewed the Supplemental Environmental Impact Statement for the draft Yosemite Valley Plan for geologic hazards and liability related to geologic hazards, and made suggestions to reduce the geohazard potential.

Southeast Region

Big Cypress National Preserve

- Provided policy and regulatory assistance regarding the legal adequacy of 25 plans of operation submitted by Collier

Resources Company; coordinated strategy for handling the plans of operation with WASO Solicitors Office.

- Provided advice on a strategy for handling the response to Collier Resources Company plan of operation for landing strips and drafted response letter regarding the adequacy of the plan.
- Conducted preliminary assessment of the potential value of the Collier mineral estate in support of a possible property exchange.
- Advised park on how to respond to damage to park resources caused by operator operating outside the scope of its approved plan, including enforcement, civil remedies, and possible cost recovery.
- Participated in park's three-day oil and gas management plan scoping meeting in Naples, Florida.

Big South Fork National Recreation Area

- Reviewed plans of operations for Saint Joseph Petroleum six gas well operation, and Tennessee Eastern three gas well operation.
- Assisted park in trying to secure funds for plugging orphaned oil and gas wells using the EPA Oil Pollution Act fund.
- Coordinated site visit by USGS to assess hydrocarbon contamination at oil and gas sites.
- Participated in status review of park's oil and gas management; briefed park on the applicability of the 9B regulations; conducted site inspection of active and abandoned oil and gas sites; prepared report with recommended actions.
- Assisted park with request from an operator to conduct a 2-D seismic shoot; reviewed and revised draft letter to the operator requesting a plan of operations, highlighting the need for proof of a property right interest to conduct seismic work.
- Assisted in developing a strategy regarding a rebuilding project along a privately held right-of-way through the park that has caused the release of acid mine drainage; coordinated response with Water Resources Division.
- Participated in meeting with USGS to discuss possible assistance in site assessments for certain contaminants at oil and gas sites.
- Advised park on strategy for handling St. Joe proposal to work over 3 gas wells in park.
- Reviewed mineral appraisal for Coal Property Tract 1609.

- Reviewed and provided comments on General Management Plan.
- Reviewed proposal to evaluate groundwater resources.
- Analyzed toxic metal chemical analysis for potential trail material.
- Provided Regional Chief of Lands information on coal appraisals as requested.

Cape Hatteras National Seashore

- Provided information that may help the park attach conditions protecting natural resources on efforts by the State of North Carolina to preserve a state highway.
- Geologist-in-the-Parks, Resource Management - Analyzed NASA's LIDAR data to gain better understanding of coastal geomorphology.

Cumberland Gap National Historical Park

- Inspected the Cudjo Cave entrance project, including the interior of the cave for possible geohazards and provided rock mechanics information; provided written findings to the park.
- Reviewed and commented on the "petition to designate lands unsuitable for surface mining" as defined by the Surface Mining Control and Reclamation Act in the State of Kentucky to lands adjacent to the park.

Cumberland Island National Seashore

- Geologist-in-the-Parks, Resource Management - Tested shoreline and dune profile monitoring protocols and recommended sampling design and frequency; collected initial data to establish baselines.

Everglades National Park

- Reviewed and provided comments to the park on the 700-page Lake Belt Limestone Mining Draft Environmental Impact Statement.
- Initiated development of a Barrier Island/Hurricane Management Plan.

Great Smoky Mountains National Park

- Site visits to finalize closure recommendations for Eagle Creek and Sugar Fork Mines, where the largest known colonies of an endangered species of bat (Eastern big-eared bat, *Corynorhinus rafinesquii*) *have been documented in collaboration with USFWS.*

Gulf Islands National Seashore

- Reviewed EIS for the Development and Production Plan for Destin Dome Unit #56 and prepared letter to NOAA on the

potential impacts from development of this unit.

- Assisted park with strategy to address 3-D seismic proposal from Fairfield Industries to conduct its operation in Gulf of Mexico waters inside park.
- Drafted memo requesting opinion from Regional Solicitor regarding the ownership status of the mineral interest covered by Fairfield's 3-D proposal; advocated park position that mineral estate vested with the U.S.
- Assisted Region with administrative appeal of Superintendent's decision to deny Fairfield's request to conduct 3-D seismic operations in the park.
- Geologist-in-the-Parks, Resource Management - Examined historic influence of structures in beach geomorphology during storm events.

Jean Lafitte National Historical Park and Preserve

- Advised park on special use permitting authority over Equilon Pipeline Co. transpark pipeline.

Kings Mountain National Military Park

- Conducted field assessment of several mines in the park and made closures recommendations.

Mammoth Cave National Park

- Assisted park in interpreting confidentially provisions of the Federal Cave Resources Protection Act.
- Provided a 4-page summary of the speleothem mineral appraisal.

Obed Wild and Scenic River

- Assisted park with request from an operator to plug and abandonment an inactive well; reviewed mineral deed to determine applicability of 9B regulations; drafted and forwarded recommendations to park.

Timucuan Ecological and Historic Preserve

- Reviewed and provided comments on the Fort George Inlet Shoreline Erosion Study.

Servicewide Project Highlights

Abandoned Mineral Lands Program

- ▶ Provided oversight on the Colorado Mine Land Reclamation Division Advisory Council which reviews abandoned mine land projects costing about \$2 million per year.
- ▶ Attended and presented papers at National Association of Abandoned Mine Land Programs annual conferences in Pennsylvania (1999) and Colorado (2000).

Interagency Coordination and Collaboration

Grand Staircase – Escalante National Monument

- ▶ Assisted the BLM with sand, rock and gravel extraction planning and restoration design on several disturbed land sites.
- ▶ Assisted the BLM in acquiring outstanding coal lease inholdings by providing mineral appraisal consultation and review during the negotiation process.
- ▶ Reviewed and provided comments on the Draft EIS for the management of the monument by the BLM.

Other Agencies

- ▶ USFS and BLM – 3 Mine Safety courses taught in Wallace, Idaho and Tucson, Arizona.
- ▶ Office of Surface Mining Conference on Bats and Mines – Paper presented entitled, Bat- Compatible Closures of Abandoned Underground Mines in the National Park System, now posted on GRD website at <http://www2.nature.nps.gov/grd/distland/amindex.htm#technicalreports>
- ▶ USFS – Provided site characterization and staff training assistance at uranium mines on Tonto National Forest.

Geology

- ▶ Geologist-in-the-Parks, Resource Management - Inventory paleontological specimens excavated from locations which are now NPS sites.
- ▶ Geologist-in-the-Parks, Resource Management and Interpretation - Set up links to retired geologic community to provide expertise via the GIP Program.
- ▶ Geologist-in-the-Parks, Resource Management - Gathered information from other countries regarding paleontological information pertinent to the understanding and management of NPS fossil resources.
- ▶ Provided comments on the draft report and risk assessment for the Jabiluka uranium mine located in Kakadu National Park, Australia, as reported to the UNESCO World Heritage Committee.

- ▶ Researched Learning Center concept in order to prepare Learning Center funding proposal for the National Cave and Karst Research Institute.

- ▶ Prepared briefing paper for the Associate Director for Natural Resources on alternatives for organizing the National Cave and Karst Research Institute.

- ▶ Reviewed and provided comments on the Clean Water Action Plan: Coastal Research and Monitoring Strategy.

- ▶ Actively recruited candidates for a Coastal Geomorphologist position and subsequently hired coastal geologist.

- ▶ Prepared report on Geology of Coastal Ecosystems Workshop.

Policy and Regulatory Assistance

- ▶ Revised four existing sections in NPS-77, caves, soils, geology, and paleontology; revised Chapter 1 and Appendix A; and drafted two new sections, disturbed land restoration and shorelines. Pulled together comprehensive list of quotes from park enabling statutes pertaining to geologic resources.

- ▶ Developed interagency report that analyzed federal fossil management compiling summary of NPS statutory and regulatory authorities that govern fossil management.

- ▶ Prepared a request to renew and revise the budget of burden hours, under the Paperwork Reduction Act, associated with complying with the Service's Part 9 mining regulations; analysis forwarded to the Department for approval along with a 60-day *Federal Register* notice.

- ▶ Added a planned revision to the Semi-Annual Regulatory Agenda to clarify language in 36 C.F.R. § 6.7, governing mine-generated solid waste disposal in parks.

- ▶ Provided input to the BLM for a report to Congress on the number of plans of operations in parks affected by the Solicitor's mill site opinion.

- ▶ Sponsored and participated in a three-day training course at Cuyahoga Valley NRA on the management of nonfederal oil and gas activities.

- ▶ Prepared analysis on interrelationship between the National Contingency plan and 9B suspension and revocation authorities for guidance to field personnel responding to a contamination spill incident.

- ▶ Reviewed and commented on draft Environmental Enforcement procedures.

- ▶ Drafted model bond form for use with 9B plans of operation; coordinated preparation and finalization of bond form with Santa Fe Field Solicitor's office.
- ▶ Advised several parks and central offices about the latest case law on federal agency tort liability and to modify various NPS documents that could inadvertently increase NPS liability.
- ▶ Provided assistance to the Albright Employee Development Center by offering the *Natural Resources Protection Law and Policy* course; course was held twice in 1999.
- ▶ Prepared comments for the Deputy Associate Director on revised *NPS Management Policies*.
- ▶ Provided comments to NPS museum management program regarding Director's Order # 24, pertaining to museum collection management.
- ▶ Coordinated, and forwarded to WASO, comments to DO #25, Land Protection.
- ▶ Determined that the NPS Index improperly characterizes the 1970 General Authorities Act as excluding "miscellaneous areas," such as affiliated areas, from the National Park System.
- ▶ Participated in intra-agency meeting discussing the Park System Resources Protection Act, 16 U.S.C. §19jj, and the procedures necessary to implement an effective field response to damages to resources in a park.

Validity Program

- ▶ Participated in the biannual meetings of the BLM Certification Panel as the NPS representative.
- ▶ Provided the Department with information on how the NPS has been accounting for the dramatic drop in the price of gold in its mineral reports.
- ▶ Provided the Regional Solicitor's office input to the post-hearing brief in the contest action involving the Comstock, Eldorado and Eureka lode claim blocks in Denali NP and Preserve.
- ▶ Prepared draft guidance for the Solicitor's Office explaining the relevance and importance of several Solicitor's opinions pertinent to the determination of valid existing rights to a patent.
- ▶ Suggested revisions to a guidance document BLM distributes to mining claimants, clarifying the process to obtain a small miner waiver from the annual maintenance fee.
- ▶ Advised parks that Environmental Assessments for validity examinations are unnecessary under applicable case law.

Other

- ▶ Provided environmental planning advice to Huascarán National Park in Peru which is attempting to mitigate environmental impacts from external open pit copper mining.
- ▶ Inspected the structural stability of the entrance to Crystal Cave for the Jeffco Open Space Board, Colorado and provide engineering options for further study.
- ▶ Reviewed the Jabiluka Uranium Mine in Kakadu National Park, Australia for the Intermountain Regional Director, a member of the World Heritage Committee; review focused on environmental impacts and mitigation alternatives.
- ▶ Provided mineral management information, at the request of the Engineering Division of the Internal Revenue Service, concerning split-estate of coal mineral rights and surface rights.
- ▶ Provided information on polyurethane foam used to stabilize the Lost Horse Mill (National Register List of Historic Structures) to a school teacher looking at innovative technology used in archeology (web site request).
- ▶ Provided dust suppression information for dirt roads to Maintenance Bulletin-board request.
- ▶ Provided AML engineering and management oversight to the Colorado Mine Land Reclamation Advisory Council fall and spring meetings.
- ▶ Worked with the IRS Minerals Division on the effects of surface owner consent on fair market value appraisal determinations.
- ▶ Provided AML closure information to U.S. Forest Service personnel in Montana.
- ▶ Provided technical assistance to New Jersey Department of Labor-Mine Safety Office
- ▶ Provided AML technical information to the visiting French Delegation via OSMRE Western Office.
- ▶ Provided assistance to U.S. Fish and Wildlife Alaska personnel on navigable waters mineral ownership issues concerning mineral appraisal planning.
- ▶ Presented paper at the National AML Conference in Steamboat Springs, CO, on Polyurethane Plug Research sponsored by GRD through the Colorado School of Mines.
- ▶ National Parks Magazine – Consulted for January/February 2001 article on NPS bat conservation initiatives.
- ▶ Western Bat Working Groups – Served as NPS representative to Colorado Bat Working Group, producing first draft of the Colorado Bat Conservation Plan.

Geologic Resources Division Staff Profiles

Zelda Chapman Bailey - Interim Director, National Cave and Karst Research Institute

Zelda's duties as the Interim Director of the National Cave and Karst Institute include moving forward with NPS efforts to establish the Institute by defining the purview and scope of operation, designing an organizational structure, forming partnerships, finding funding sources and a physical facility, and defining research needs. Her previous work experience includes various positions with the USGS, including Assistant District Chief for Operations in the Caribbean District, Associate District Chief for Hydrologic Studies in Colorado, and Acting District Chief for Colorado and Wyoming. Zelda has a degree in geology from Indiana University. Telephone: 303-969-2082; e-mail: zelda_bailey@nps.gov

Rebecca L. Beavers - Coastal Geologist

Rebecca is responsible for marine resource, coastal geomorphology, coastal processes, and resource management related issues. She has worked with the U.S. Geological Survey and the U.S. Army Corps of Engineers on a variety of coastal and nearshore research projects since 1993. Rebecca held a Research Assistant Professor and now adjunct faculty appointment at the University of North Carolina at Wilmington. She has worked with GRD since 2000. B.A. in Biology and Geology (Williams College), Ph.D. in Geology (Duke University). Telephone: 303-987-6945, e-mail: rebecca_beavers@nps.gov

Julia Brunner - Policy and Regulations Specialist

Julia works on regulatory and policy issues related to mining claims, nonfederal mineral operations, geologic resources (particularly geohazards and coastal issues), paleontological resources, mining-generated solid waste, wilderness, and disturbed land restoration. Before joining the Division, Julia clerked at a law firm and for the Idaho Supreme Court. Julia holds a B.A. in biology with an ecology emphasis from Dartmouth College and a J.D. from the University of California-Berkeley-Boalt School of Law. Telephone: 303-969-2012, e-mail: julia_f_brunner@nps.gov

John E. Burghardt - Geologist/Certified Mineral Examiner

John's duties are split evenly between coordinating the Mining Claim Validity Program and participating in the Abandoned Mine Lands segment of the Disturbed Land Restoration Program. John provides mine safety instruction to federal and state agencies and participates in bat conservation initiatives as they relate to bat habitat in abandoned mines.

John represents the NPS on the Bureau of Land Management's National Mineral Examiner Certification Panel, and on the Colorado Advisory Board of the Western States Bat Working Group. He worked for 10 years as a miner, surveyor, and engineer for Amax, Inc. at Henderson Mine. He received a B.S. in geology from Colorado State University in December 1976. Telephone: 303-969-2099, e-mail: john_burghardt@nps.gov

Philip Cloues - Mining Engineer/Mineral Economist

Provides expertise for the Division in mining and exploration plan evaluation, environmental mitigation, regulation analysis for leaseable, locatable, and mineral material development, mineral appraisal, economic feasibility analysis, mineral royalties, equipment selection, mine restoration, and geohazard assessment. Phil worked for four years in the private sector, spent two years with the Peace Corps (Ministry of Mines in Venezuela), and 30 years with DOI (USGS/10, MMS/2, BLM/6, and NPS/12). MS Mineral Economics & EM Mining Engineering/Colorado School of Mines. Telephone: 303-969-2148, e-mail: phil_cloues@nps.gov

Tim Connors - Geologist

Tim's major duties include oversight of the Geologic Resources Inventory as well as general computer support, web page development, and providing Geographic Information Support (GIS) to the division. He has been with the NPS and GRD for three years. Tim's educational background includes an MS in Geology (1996, University of Toledo, Toledo Ohio) and a BS in Geology (1991, University of Toledo, Toledo Ohio). Telephone: 303-969-2093, e-mail: tim_connors@nps.gov

Sid Covington - Geologist/Certified Mineral Examiner

Sid is the Division contact for geothermal resources, aeolian processes and geologic input for park planning documents. He is also a Certified Mineral Examiner. Sid has worked for private industry as an exploration geologist, production geologist, and a Land Reclamation Superintendent. He was also an Assistant Professor of Geology and Mathematics at Colorado Mountain College. Sid's government service includes duties as a mineral examiner with the U.S. Forest Service, and a coal and petroleum geologist with the U.S. Geological Survey. Sid holds an M.S. degree in geology from Florida State University. Telephone: 303-969-2154; e-mail: sid_covington@nps.gov

Judy L. Geniac - Environmental Protection Specialist

Judy manages the Natural Resource Program Center's GeoScientist-in-the-Parks Program. She helps parks identify physical and associated ecological resource projects, the type and level of expertise needed, and funding sources and individuals to do the work. Previously, she worked for the U.S. Fish and Wildlife Service, Bureau of Land Management, Corps of Engineers, and other NPS offices: Everglades NP, Big Cypress NP&P, and Colorado NM, and the Water Resources Division via the Colorado State University. Judy has a B.A. in biology and masters credits in environmental management. Telephone: 303-969-2015; e-mail: judy_geniac@nps.gov

Deanna C. Greco - Geologist

Deanna works with the Division's Disturbed Lands Restoration Program where she serves as a servicewide technical expert on physical restoration and resource management, protection and mitigation. She has previously worked with the U.S. Army Corps of Engineers and the Bureau of Land Management. Deanna holds a degree in Geology from the University of Arkansas. Telephone: 303-969-2351; e-mail: deanna_greco@nps.gov

Bruce Heise - Geologist

Bruce is responsible for administering the Inventory and Monitoring Program's Geologic Resource Inventory. He coordinates partnerships between the NPS and a variety of earth science organizations and also serves as the NPS liaison with the USGS Central Region Geologic Division. Bruce's previous work experience includes two years experience with the USGS and ten years in the oil and gas industry. He holds a BS in Geology from the University of Massachusetts, MS in Geology from the University of Montana. Telephone: 303-969-2017; e-mail: bruce_hesie@nps.gov

Robert D. Higgins - Chief, Science & Technical Services Branch

Bob manages the Division's Science and Technical Services branch and is responsible for Servicewide geologic programs, supporting NPS geologic research, planning, resource protection, education, interpretation, I&M, and information transfer. He also serves as the Servicewide contact on geology and performance management. Bob has over 30 years experience in geologic resource management, including minerals exploration and leasing, crystallographic research, oil & gas exploration and reserves engineering, and earthquake research. He holds a BS in Geology from the University of Arizona and an MA in Engineering Administration from George Washington University. Telephone: 303-969-2018; e-mail: bob_higgins@nps.gov

Edward Otto Kassman, Jr. - Regulatory Specialist

Ed has been a policy and regulations specialist with the Division since 1993. He is the Division's point of contact for regulatory/policy issues related to the exercise of nonfederal oil and gas rights, federal mineral leasing, nonfederal mineral operations, external threats to park resources, and in-park administrative use of mineral materials. Ed holds a B.A. in history from the University of Colorado in Boulder and a J.D. from Suffolk University Law School. Telephone: 303-969-2146; e-mail: edward_kassman@nps.gov

Ronal C. Kerbo - National Cave Management Coordinator

Ron coordinates a Servicewide program to protect cave and karst resources, provides advice and consultation to the Washington office, Regions, and Parks in the development and implementation of cave related resource management programs. He has been a cave specialist for the NPS for 25 years, caving for over 35 years. Ron is an honorary life member and Fellow of the National Speleological Society, member of Cave Research Foundation, Honorary Director of the American Cave Conservation Association, and a Director of the Karst Waters Institute. Telephone: 303-969-2097; e-mail: ron_kerbo@nps.gov

Carol McCoy - Chief, Policy and Regulations Branch

Carol manages the Policy and Regulations Branch. She is responsible for the development and application of NPS policies and regulations re: minerals management and geologic resources; training; litigation support; legislation; input on other agencies' regulations and policies; and assistance on policy matters that span the Natural Resource Program Center. Carol has worked for the federal government on regulatory and policy matters for 23 years: first with EPA then the NPS. Carol holds a B.A. in environmental studies from Brown University, a Masters Degree in public policy from the University of Michigan-Ann Arbor, and a J.D. from Georgetown University Law Center. Telephone: 303-969-2096; e-mail: carol_mccoy@nps.gov

Kerry W. Moss - Environmental Protection Specialist

Kerry coordinates Division's external minerals function that focuses on elimination or mitigation of cross boundary impacts to NPS resources from adjacent minerals and energy exploration and development. Kerry specializes in hardrock, placer, and coal mine planning, permitting, environmental compliance and impact mitigation. His past work experience includes 3 years with the Jefferson County (CO) Sheriffs Department, 3 years with Conoco Oil, and 17 years with the NPS. Educational background in Criminal Justice and Environmental Planning. Telephone: 303-969-2634; e-mail: kerry_moss@nps.gov

Elizabeth S. Norby (Lisa) – Petroleum Geologist

Lisa's duties include oil and gas planning, technical evaluation of plans of operations, and recommendation of resource protection measures that can be implemented at oil and gas sites. She has worked in the NPS for 8 years as a petroleum geologist and previously as a natural resource specialist doing resource planning and NEPA compliance. She has also worked for 12 years as a Geophysicist and Geologist with Mobil Oil Corporation. Lisa holds a B.S. in geology (Ohio University), M.S. in geology (Idaho State University), and Masters in Environmental Planning and Management (University of Denver) Telephone: 303-969-2318; e-mail: lisa_norby@nps.gov

Patrick O'Dell - Petroleum Engineer

Pat is the point of contact for oil and gas development issues in and near parks. He is responsible for assessing impacts of oil and gas activity in and around parks, and developing measures to minimize or remove such impacts. Pat's prior work experience includes work in California and Alaska on environmental and safety compliance and 10 years with Marathon Oil Company working with well workover and production operations as well as field development planning, reserve determination, and property evaluation for purchase or sale. Pat has a BS in petroleum engineering from Montana College of Mineral Science and Technology (1982) and is a registered professional petroleum engineer. Telephone: 303-969-2013; e-mail: pat_o'dell@nps.gov

Harold (Hal) S. Pranger, Jr. - Geologist

Hal works as a geomorphologist, serving primarily as a technical expert on the restoration of disturbed lands such as deteriorating stream channels, gravel pits, ponds and roads. He also evaluates the impact of natural geologic processes on park natural resources, cultural resources, infrastructure and visitors. Previously, Hal worked three years as a geomorphologist for consulting firms in Colorado and Oregon, two years as a hydrologist for the state of Wyoming coal regulatory program, and nine years as a hydrologist for the U.S. Office of Surface Mining. Hal holds geology degrees from Colorado State University and Calvin College. Telephone: 303-987-6923; e-mail: hal_pranger@nps.gov

David B. Shaver - Chief, Geologic Resources Division

Dave is responsible for the Division's overall management and program direction. Has 25 years of federal policy, regulatory, and management experience beginning with U.S. Environmental Protection Agency in 1976. He came to the NPS Air Quality Division in 1979, and served as manager of the NPS minerals management office from 1983 to 1995, when the office function was broadened to geologic resources management. Dave has a B.S. in Economics (University of Minnesota), an M.S. in Environmental Science (University of Wisconsin), and a J.D. (Georgetown University Law Center). Telephone: 303-969-2094; email: dave_shaver@nps.gov

David L. Steensen - Geologist

Dave is the Program Manager for the Servicewide Disturbed Lands Restoration and Abandoned Mineral Lands Reclamation programs. He serves as a technical consultant on issues relating to surficial geologic features and processes, including serving as Servicewide contact on restoration and performance management implementation. Dave has worked for the NPS for 15 years as a geologist (Redwood NP, GRD) and has over 17 years experience in geomorphology and landscape restoration and analysis. He holds M.S. (California State Univ., Humboldt) and B.S. (W. Washington Univ.) degrees in geology. Telephone: 303-969-2014; e-mail: dave_steensen@nps.gov

James F. Wood - Geologist

Jim is the Education Specialist for the Division. He coordinates NPS geologic educational goals with external partners and works with parks to develop educational programs, general interest geology publications, and Internet sites. Jim began his NPS career at Redwood National Park in 1986 and also worked at Yellowstone National Park. He holds a BS degree in Physical Science and an MA in Environmental Education (California State Univ., Humboldt). Telephone: 303-969-2149; e-mail: jim_f_wood@nps.gov

Jim C. Woods - Chief, Mineral Operations Branch

Jim manages the Division's Mineral Operations Branch and is responsible for the technical evaluation of proposed mineral development inside parks, on-site inspection of mineral operations, park minerals management planning, and development of NPS sand and gravel extraction plans. He also provides guidance documents for mineral operators in parks, and is a technical liaison on minerals development proposals external to parks. Jim has worked for the NPS for 23 years as a natural resource and minerals management specialist in parks (Padre Island NS and Big Thicket NP) and in the Division. Jim has a B.S. in marine biology (Texas A&I University at Corpus Christi). Telephone: 303-969-2635; email: jim_c_woods@nps.gov

Mark Sandy Ziegenbein - Mining Geologist

Mark is the Division contact for in-park mining and sand and gravel extraction issues. He is also a Certified Mineral Examiner and assists parks with disturbed land inventory, restoration design and implementation. Mark has over 20 years of combined experience working on mining, environmental, and disturbed land restoration projects for Bechtel Inc., the Bureau of Land Management, Dames and Moore, Santa Fe Mining Inc. and the NPS. He holds Bachelor of Science degree in Geology (1978). Telephone: 303-969-2957; e-mail: mark_ziegenbein@nps.gov

Organization and Staff



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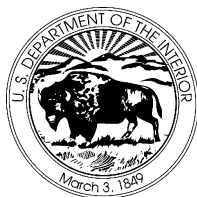
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As the national's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.