

Fossils, U.S. Geological Survey and the Public Lands

By John Pojeta, Jr.

Knowledge of fossils is critical to understanding Earth history and past life. Fossils allow geologists to establish time lines by which scientists can correlate past events, and fossils are the direct evidence of the evolution of species over the past 3.45 billion years.

Within the National Park Service (NPS), the U.S. Geological Survey (USGS) has two formal ongoing cooperative studies at Petrified Forest National Park (PFNP) and Dinosaur National Monument (DNM). Fossilized spores and pollen are being recovered from the Mesozoic Chinle and Morrison Formations. These plant microfossils are analyzed to interpret the geological history and paleoenvironments of these formations, which are geographically widespread in the Western Interior. These formations crop out in the northern and southern Rocky Mountains and in the Colorado Plateau region. The rocks contain economic deposits of uranium and vanadium, and are renowned worldwide for the diverse and well-preserved Mesozoic fossils they contain.

The research on the Chinle Formation at PFNP is a topical study in support of the National Cooperative Geologic Mapping Program. The USGS project is led by Ronald J. Litwin, who works cooperatively with Park Superintendent Gary Cummins, Chief Ranger Kerry Isensee, and Park Paleontologist Vincent Santucci. The exposures of the Chinle Formation at the Park have provided the opportunity to establish the fossil pollen transition across the boundaries of two of the stages in the Late Triassic near the beginning of dinosaur evolution. Previously, similar studies of Late Triassic pollen and spores were done at Manassas Battlefield National Park, Virginia.

The DNM studies are coordinated by Christine Peterson (USGS, Denver) and Dan Chure (Park Paleontologist, DNM.) Pete Peterson (USGS, Denver) is the senior scientist in this multidisciplinary examination of the biostratigraphy and lithostratigraphy of the Upper Jurassic Morrison Formation. Ron Litwin is examining the fossil pollen and spore succession from all major dinosaur quarry sites in the Morrison Formation in the west. Until this work commenced, the documented record of pollen from the Morrison was sparse. However, more than a dozen new pollen sites have been discovered to date, and over 150 samples are currently under study.

The USGS is the Federal agency charged with collecting, studying and publishing reports about fossils. Throughout most of the 113-year history of the USGS, paleontologists have been placed in a separate administrative unit. For much of the 20th Century, this unit has been called the Paleontology and Stratigraphy Branch (P&S). At the present time, P&S has 51 paleontologists.

Paleontological expertise in P&S covers most aspects of research on fossils. Studies of invertebrate fossils are performed on clams, snails, ammonites, and various smaller groups of mollusks throughout the known time ranges of these

shells; Paleozoic brachiopods; graptolites; trilobites; and Paleozoic corals. Vertebrate studies include Cenozoic mammals and trace fossils, dinosaurs, and Triassic trace fossils. Paleobotanical research is conducted on both plant and pollen fossils from Paleozoic, Mesozoic, and Cenozoic rocks. Micropaleontological studies include pollen, marine and fresh water diatoms, ostracodes, nannofossils, foraminifera, dinoflagellates, conodonts, and radiolarians, throughout most of the known time ranges of each of these groups.

Within the USGS, paleontological studies are important to the success of a number of programs including National Cooperative Geologic Mapping, Global Change and Climate History, National Mineral Resource Assessment, Evolution of Sedimentary Basins, Coal Investigations, Oil and Gas Investigations, Off-shore Geologic Framework, and Earthquake Hazards Reduction.

In addition to cooperative projects with NPS, the P&S Branch also carries on studies in support of other government agencies including Department of Energy at the Savannah River Plant and the USAID Coal studies in Pakistan. In cooperation with the Water Resources Division of the USGS, the Branch is also conducting stratigraphic studies in Abu Dhabi of the United Arab Emirates. In the recent past, P&S has conducted studies for the Department of Defense at Eniwetok Atoll and for the Department of Energy at Yucca Mountain.

The P&S Branch also regularly identifies fossils for a wide variety of organizations and individuals, including other USGS research projects, universities, State geological surveys, individual citizens, and other Federal agencies. In this last category, P&S has most recently worked with the Bureau of Land Management (BLM) the Forest Service (FS).

In May 1992, the USGS, BLM, NPS, and FS, signed a Memorandum of Understanding (MOU) for "Management of Fossils on Public Lands." This MOU created an interagency working group known as "The Federal Interagency Paleontological Working Group" (FIPWIG). This working group consists of: Chief, Branch of Paleontology and Stratigraphy (USGS); Chief, Division of Recreation, Cultural, and Wilderness Resources (BLM); Chief, Wildlife and Vegetation Division (NPS); and Geology Program Specialist, Minerals and Geology Management Staff (FS), or their delegates. The USGS delegate to FIPWIG is the permanent working group chair. FIPWIG meets early each fiscal year to identify and prioritize anticipated needs of the land managing agencies. Additional meetings can be convened as required.

Also in May 1992, Public Law 102-285 the "National Geological Mapping Act of 1992" was enacted. Among other things, this act established the "National Cooperative Mapping Program" (NCMP). One of the program objectives of NCMP is "Development of a...national paleontologic data base.... Representative categories of interdisciplinary support shall include...paleontologic investigations that provide information...to a national paleontologic data base..." The National Paleontological Data Base (NPDB) will be maintained by the USGS as authorized by the legislation.

Since its founding, the USGS has been assembling data on the Nation's fossils, and these data form the core of the NPDB. The data base already has information on about 250,000 fossil localities from which information can be supplied to land-managing agencies. New research is continually expanding the data base, and a dedicated effort is being made to make the NPDB as complete as possible.

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Figure 1: Senator Gore and Mrs. Gore with USGS scientists examining dinosaur footprints in Upper Triassic lake deposits near Culpeper, Virginia.