NRC NAS NAE IOM

Paleontological Collecting

Excerpts

Paleontological Collecting

Committee on Guidelines for Paleontological Collecting
Board on Earth Sciences
Commission on Physical Sciences, Mathematics, and Resources
National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1987

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Frank Press is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Robert M. White is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Samuel O. Thier is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Frank Press and Dr. Robert M. White are chairman and vice chairman, respectively, of the National Research Council.

Support for this project was provided by the following agencies: the Atlantic Richfield Foundation, Bureau of Land Management (Department of the Interior), Office of Surface Mining (Department of the Interior), Smithsonian Institution, U.S. Geological Survey (Department of the Interior), and Utah International, Inc.

Available from
Committee on Guidelines for Paleontological Collecting
Board on Earth Sciences
2101 Constitution Avenue
Washington, D.C. 20418

COMMITTEE ON GUIDELINES FOR PALEONTOLOGICAL COLLECTING

David M. Raup, University of Chicago, Chairman
Craig C. Black, Los Angeles County Museum of Natural History
Sandra Blackstone, University of Denver
Hollis Dole, Lake Oswego, Oregon
Sterling Grogan, Utah International Inc.
Peter Larson, Black Hills Institute of Geological Research, Inc.
Farish Jenkins, Jr., Harvard University
John Pojeta, Jr., U.S. Geological Survey
Peter Robinson, University of Colorado Museum
Charles Roybal, New Mexico Energy and Minerals Department
J. William Schopf, University of California
Francis G. Stehli, University of Oklahoma
Donald Wolberg, New Mexico Bureau of Mines and Mineral Resources

Liaison Members

Carl Barna, Bureau of Land Management
Bruce Hanshaw, U.S. Geological Survey
George Kolstad, Department of Energy
J. F. Lance, National Science Foundation (retired)
Charles M. McKinney, National Park Service
Fred A. Nelson, Atlantic Richfield Foundation
Allen Perry, U.S. Department of the Interior

Staff

William E. Benson, Senior Staff Officer
Shirley E. Cole, Administrative Secretary
Joseph W. Berg, Jr., Staff Director
Roger D. K. Thomas, Franklin and Marshall College

BOARD ON EARTH SCIENCES

W.G. Ernst, University of California, Los Angeles, Chairman
Robin Brett, U.S. Geological Survey
Randolph W. Bromery, University of Massachusetts
Lawrence M. Cathles, Cornell University
Larry W. Finger, Carnegie Institution of Washington
Robert N. Ginsburg, University of Miami
Alexander F. H. Goetz, University of Colorado
Kate H. Hadley, Exxon Company, U.S.A.
Michel T. Halbouty, M. T. Halbouty Energy Company
Joseph V. Smith, University of Chicago
Sean C. Solomon, Massachusetts Institute of Technology
Steven Stanley, Johns Hopkins University
George A. Thompson, Stanford University
Donald L. Turcotte, Cornell University

Ex-Officio Members

Paul B. Barton, Jr., U.S. Geological Survey
Donald M. Hunten, University of Arizona

Liaison Members

Miriam Baltuck, National Aeronautics and Space Administration
Jerry Brown, National Science Foundation
Philip Cohen, U.S. Geological Survey
Bruce R. Doe, U.S. Geological Survey
Robert M. Hamilton, U.S. Geological Survey
Bruce B. Hanshaw, 28th International Geological Congress
James F. Hays, National Science Foundation
John G. Heacock, Office of Naval Research
Donald F. Heinrichs, National Science Foundation
Marvin E. Kauffman, American Geological Institute
William M. Kaula, National Oceanic and Atmospheric Administration
Ben Kelly, U.S. Army Corps of Engineers
George A. Kolstad, Department of Energy
Ian D. MacGregor, National Science Foundation
Andrew Murphy, U.S. Nuclear Regulatory Commission
Dallas L. Peck, U.S. Geological Survey
John J. Schanz, Jr., Congressional Research Service
Shelby G. Tilford, National Aeronautics and Space Administration
Raymond G. Watts, U.S. Geological Survey
Kenneth N. Weaver, Maryland Geological Survey
Arthur J. Zeizel, Federal Emergency Management Agency

Joseph W. Berg, Jr., Staff Director
William E. Benson, Senior Staff Officer

PREFACE

The Committee on Guidelines for Paleontological Collecting was created by the National Academy of Sciences in mid-1984 to serve through June 30, 1987, under the auspices of the Board on Earth Sciences of the Academy's Commission on Physical Sciences, Mathematics, and Resources. The Committee began to hold meetings in the spring of 1985 to develop a general statement on the appropriate role of government in the regulation (or lack thereof) of field collecting of the fossils of prehistoric plants and animals.

The catalyst that led to the formation of the Committee was a 1981 meeting in Farmington, New Mexico, that centered on surface mining, particularly surface coal mining in New Mexico, and the impact of this activity on scientific and hobby collecting of fossils by scientists and hobbyists.

The Committee's 13 members included a cross-section of the professional paleontological community as well as representatives of state and federal governments, the surface-mining industry, and commercial businesses dealing in fossils. The members represented a wide range of backgrounds, experience, and points of view, and individual Committee members functioned in overlapping capacities. Included were current or former employees of federal and state governments, industry, museums, academic institutions, private enterprises that deal in fossils, and the law. Several members of the Committee were professionally-trained research paleontologists, and all members had some background in problems of collecting fossils.

However, a group of 13 individuals could not cover all possible aspects of the subject from all points of view. To offset these difficulties, help was sought from a number of dedicated consultants and liaison members from state and federal agencies, paleontological societies, and the paleontological community at large. The Committee also investigated procedures for dealing with fossil collecting in Great Britain, Canada, and the Federal Republic of Germany.

The Committee held six formal meetings, either in Washington or at other sites appropriate to studying different aspects of the problem. The location of those sites along with public announcements of the existence and activities of the Committee and cognate activities of other groups and committees can be found in appendixes to the report.

EXECUTIVE SUMMARY

The Committee on Guidelines for Paleontological Collecting, by its charge, was concerned mainly with the extent to which federal land managers should control or restrict fossil collecting on public lands.

The charge of the Committee seemed simple at first. It reduced to this apparently straightforward question:

> How should government protect and preserve fossils of extinct plants and animals while at the same time allowing other legitimate uses of the land and encouraging the scientific study of fossils?

The implication was that the destruction of fossils should be prevented whenever and wherever possible. It would seem, therefore, that the task of the Committee should have been to develop a set of guidelines for a system of regulation to "protect and preserve" fossils. The task should have been made easier by the fact that a large number of federal agencies with land management responsibilities already have regulatory systems in place.

The Committee found, however, that the problem is much more complex. Some of the salient difficulties are:

(1) Fossils are so numerous in some of the rocks of the Earth's crust that blanket statements such as "all fossils must be protected" are meaningless. If such statements were applied literally, the entire coal industry and major parts of the building-stone industry would cease to exist because their raw materials consist largely of fossils.

(2) Almost all fossil collecting produces new and interesting specimens because the study of ancient life is still in an exploratory phase. Therefore, to say that a fossil is "new to science" is not helpful in deciding which fossils require special protection.

(3) It is virtually impossible to determine, <u>a priori</u>, the scientific significance of a deposit of fossils. With a few special exceptions, a fossil's scientific value can be assessed <u>only after it has been collected</u>, prepared in a laboratory, and studied. Even after study, the scientific importance of a fossil is difficult to codify because so much depends on the changing context of evolving knowledge.

(4) A fossil left in the field, either embedded in rock or resting on a weathered surface, will eventually be destroyed by the natural processes of weathering and erosion.

In the foregoing aspects, fossils are very different from human artifacts, but past attempts at regulation have tended to confuse the two. This has led to uncritical and often unfortunate transfers of standards and procedures from archeology to paleontology.

In its further investigations, the Committee was dismayed to learn of the number of instances of disruption of collecting by what seem to be overzealous regulatory activities of federal agencies. Cases range from a Harvard biology professor who was apprehended in Montana for collecting fossils after inadvertently crossing an unmarked boundary of BLM land to an elderly hobbyist who was arrested in South Dakota for collecting seven rather undistinguished fossils in a National Forest. The government pressed charges in both cases: that of the Harvard professor was dismissed by a U. S. District Court on the grounds that the statute used in the case (Antiquities Act of 1906) was unconstitutional; and that of the South Dakota hobbyist was settled following a plea of nolo contendere and payment of a fine.

In a potentially far-reaching action, the Forest Service has taken steps to require permits for all collecting of sedimentary rocks on Forest Service land on the grounds that these rocks might contain fossils. This is disturbing because of the impact it could have on the teaching of basic field geology in colleges and universities and on the science of paleontology. Fortunately, the Forest Service has announced its intention to limit the permit requirement to vertebrate fossils and to commercial activities (36 CFR Part 261, August 26, 1986). However, the Forest Service is just one of more than 60 federal agencies that have--or assume--regulatory responsibility for fossil collecting.

After much discussion and soul-searching, the Committee adopted the following statement of principle as a basis for its detailed recommendations:

> In general, the science of paleontology* is best served by unimpeded access to fossils and fossil-bearing rocks in the field. Paleontology's need for unimpeded access is in sharp contrast to the prevailing situation in archeology. In this report, 'access' is defined to include all collecting and removal of fossiliferous material for study and preservation. Generally, no scientific purpose is served by special systems of notification before collecting and reporting after collecting because these functions are performed well by existing mechanisms of scientific communication. From a scientific viewpoint, the role of the land manager should be to facilitate exploration for, and collection of, paleontological materials.

---

*Fossils have a broad geologic significance and their study is important to other subdisciplines of geology as well as to paleontology, e.g., stratigraphy, sedimentology, sedimentary geochemistry. Therefore, when this report speaks of the needs of paleontology and the best interests of paleontologists, the intent is to include all the disciplines and scientists who need and use fossils in their research.

In line with this principle, the Committee's specific recommendations are designed to reduce rather than promote regulation. If taken out of context, these recommendations carry the unfortunate implication that the Committee members do not think fossils are important enough to "protect and preserve." Nothing could be further from the truth. We all recognize and appreciate the great importance of fossils both to science and to society, but we also realize that an uncollected and unstudied fossil is of no value. We feel strongly that only with unimpeded access can our knowledge of ancient life move ahead with vigor.

It should be emphasized also that the Committee recognizes that some fossils and fossil deposits are sufficiently unusual or important to require special regulation, and we have proposed a system for this that uses an existing program for designation of natural landmarks on public lands. Even in these cases, however, we are recommending that continued collecting and study for scientific purposes be allowed because, even in these special situations, it makes no sense to inhibit the scientific study of fossils.

The Committee also recognizes that the legislation used to establish national parks and monuments obliges the National Park Service to protect fossils in park areas used heavily by the general public (see Appendix R for further discussion).

The Committee's recommendations are likely to be controversial because several of them are in direct conflict with the existing philosophies and practices of a number of federal agencies. These agencies have important and valid land management responsibilities but in some cases they have interpreted existing laws as requiring them to "protect and preserve" fossils in a manner similar to the conventional treatment of human artifacts. In these cases, the agencies have established programs of inventory and salvage similar to those in archeology. We challenge the archeology-paleontology link and urge a different approach to the problem of fossil collecting, an approach that would both benefit the science and reduce the burden on the land managers.

At its final meeting, held in Los Angeles on September 14, 1986, the Committee voted unanimously to approve the 10 recommendations given below. All 13 Committee members were present and voting. Unanimous approval was also given to explanatory and qualifying statements appended to Recommendations 3, 5, 7, and 9. These are included with the full list of recommendations in Part 5 of this report.

Recommendation #1. A uniform national policy on paleontological collecting should be adopted by all federal agencies. Existing statutory authority is adequate for implementation of such a policy.

Recommendation #2. Each state should adopt a uniform paleontological policy for state-owned lands.

Recommendation #3. All public lands should be open to fossil collecting for scientific purposes. Except in cases involving quarrying or commercial collecting, collecting fossils on public

land should not be subject to permit requirements or other regulation.* [see Part 5 for elaboration]

Recommendation #4. Fossils of scientific significance should be deposited in institutions where there are established research and educational programs in paleontology. These repositories will ensure that specimens are accessioned, maintained, and remain available for study and education. There is no justification for requiring that fossils be deposited in an institution in the same state in which they were found; such requirements discourage paleontological research.

Recommendation #5. Commercial collecting of fossils from public lands should be regulated to minimize the risk of losing fossils and data of importance to paleontology. Permit applications must be subject to review by paleontologists qualified to assess the projects' potential impact on related research programs. Applications must receive the endorsement of a paleontologist who is willing to supply guidance to the commercial operation. Specimens deemed to be of special scientific interest must be deposited in a public institution, such as a museum, college, or university. [see Part 5 for elaboration]

Recommendation #6. Private landowners should follow the guideline that commercial collecting of fossils be undertaken with thorough scientific oversight to ensure that the scientific usefulness of specimens is not impaired.

Recommendation #7. Blanket paleontological inventories, mitigation, or salvage activities should not be undertaken, funded or required by government agencies as a routine part of environmental assessment, impact analysis, permitting, land management, or similar programs. [see Part 5 for elaboration]

Recommendation #8. Land managers or developers who require scientific guidance on perceived paleontological problems should initially seek advice from the U. S. Geological Survey, or appropriate state geological surveys, which in turn may wish to contact appropriate paleontological organizations.

Recommendation #9. The Department of the Interior, in cooperation with the professional paleontological community, should identify and evaluate potential paleontological localities of national significance (both on public and private lands) for designation as National Natural Landmarks (NNLs), pursuant to the existing National Natural Landmark Program administered by the National Park Service (36 CFR 62). [see Part 5 for elaboration]

Recommendation #10. The paleontological societies of the nation should develop permanent and broadly based educational programs to inform landowners and commercial and amateur collectors of the research needs of professional paleontologists.

---

*As noted above, this recommendation would not apply to National Parks, where permits would still be required for all collecting.

Several of these recommendations refer to commercial collecting, and this is one of the most sensitive and difficult aspects of the overall problem. Many paleontologists find the sale of fossils repugnant on esthetic and moral grounds and because the increasing use of spectacular fossils as art objects encourages over-collecting of rare species. In keeping with this view, the Society of Vertebrate Paleontology (SVP) has made a number of statements protesting commercial activities. In 1973, for example, the Society adopted the following resolution:

> The SVP goes on record as opposing the sale to the public of fossil specimens of any sort and that this resolution should be sent to the Secretary of the Interior and the Secretary of Agriculture of the United States.

The general feeling against the sale of fossils has led recently to an agreement among the major natural history museums to stop selling fossils in museum shops. It has also led to a number of attempts to limit or prohibit all fossil collecting for commercial purposes.

As the Committee learned, however, prohibition of all commercial fossil collecting and trafficking would create other problems. For example, most schools and colleges lack resident collections of fossils and must purchase study specimens for classroom use. Also, it is not uncommon for research museums to contract with collectors to obtain fossils of special scientific or display interest, just as zoos often employ professional collectors.

The Committee found it extremely difficult to resolve the legitimate but competing arguments concerning commercial collecting, and the Committee was itself a source of widely divergent views. We have arrived at a compromise position, embodied in Recommendations 4, 5, and 6, which we hope is a reasonable position between the extremes of complete prohibition and total deregulation.

Recommendation 7 also contains controversial elements. At first glance, it would seem that the land manager cannot do his or her job properly without first inventorying all resources on a tract of land. Although this principle is probably valid for certain conventional, easy-to-assess resources, such as some surface mineral deposits, wildlife, and vegetation, the Committee recommends that such automatic and blanket inventory work for fossils is not in the best interests of furthering scientific knowledge. This is partly due to the high cost and virtual impossibility of even reasonably complete paleontological inventories and partly because the real scientific significance* of a fossil deposit can rarely be determined until after collecting and thorough laboratory study. Although a minority of the scientific community favor inventory programs, the Committee's stance on this question conforms to the opinion of most paleontologists (see second quote below).

---

*This significance can include sedimentary processes, basin processes, paleoecology, and sedimentary chemistry, as well as paleontology sensu strictu.

Indeed, despite the fact that some aspects of the fossil collecting problem remain controversial, it is encouraging to note that the Committee's recommendations are identical in spirit, and very similar in detail, to those adopted by the Paleontological Society in a Position Paper issued on November 5, 1979. The writers of this statement concluded (in part) that:

> "Any proposed law or regulation restricting fossil collection must recognize the fossiliferous nature of rocks and the need for law and regulation only for unusual, rare, specific categories of fossils."
> and ...
> "The Federal Government should provide little in the way of funds to support evaluation and collection of fossils under 'collection' and 'protection' programs."

The complete text of the 1979 Position Paper is given in Appendix L.

By urging a simplification of routine regulatory procedures, the Committee hopes and expects that its recommendations will be an important step toward helping those charged with management of public lands. With the implementation of our recommendations, the land manager will be able to devote more time to those relatively few cases where regulation is both necessary and desirable. And the science of paleontology will be advanced by eliminating much of the unnecessary complexity of the present (and proposed) regulation of fossil collecting on public lands.

1. INTRODUCTION

The Charge

The Committee on Guidelines for Paleontological Collecting was established to study the problems of paleontological collecting vis-à-vis other uses of the land.

The specific charge, as given in letters appointing its 13 members, was as follows:

> The task of the Committee will be to: (1) study the problem of access to and preservation of scientifically important paleontological materials during surface development operations such as mining, construction, etc.; (2) develop a suggested set of criteria or guidelines that can, if adopted, insure preservation of these materials without unduly hampering or restricting developmental activities; and (3) publish a set of guidelines for potential use by scientists, industrial concerns, and regulatory agencies. The product of these activities will be a report.

In so far as practicable, the Committee adhered to this charge, but it altered and expanded the charge as necessary during deliberations. Technical terms used in the report are defined in the glossary given in Appendix E.

Among the multiple concerns addressed by the Committee, six stood out:

(1) The needs of the science of paleontology as a whole and the special needs of the major subdisciplines of paleontology;

(2) The reported conflicts between collectors of fossils and land managers or developers;

(3) Access to lands, both public and private, for persons wishing to collect fossils and/or to conduct scientific studies that depend upon the collecting of fossils;

(4) The desirability of a single coordinated policy on paleontology for all federal land-managing agencies;

(5) The need to educate land managers, private landowners, the public, and developers about the differences in methods and field activities between paleontology and archeology; and

(6) The fundamental differences between paleontology and archeology, particularly in regard to differences in methods of collecting and the relative rarity of fossils and human artifacts.

In addition, the Committee was cognizant of the following section of the 1987 'Omnibus Spending Bill,' (Congressional Record -- House, October 15, 1985, p. H. 10679, Sec. 121), valid through September 1987:

> "None of the funds provided by this Act shall be expended by the Secretary of the Interior to promulgate final regulations concerning Paleontological research on Federal lands until the Secretary has received the National Academy of Sciences' report concerning the permitting and post-permitting regulations concerning paleontological research and until the Secretary has, within 30 days, submitted a report to the appropriate committee of the Congress comparing the National Academy of Sciences' report with the proposed regulations of the Department of the Interior."

Background

The Committee was appointed because of increasing concern by scientists over conflicts between collectors of fossils and land managers, developers, and other constituencies (Appendix L). For many years, the major area of conflict involved vertebrate fossils and various, mostly federal, land-managing agencies. However, the conflict has now expanded to include all of paleontology, and it is having an impact on all sciences that use fossils. Even hobby collectors have been involved in the conflict (Appendix L).

Historically, the various interest groups involved have shown little effective cooperation and little agreement on issues and policy development. Throughout the western United States, coordination of planned surface disturbances is complicated by substitute checkerboard patterns of land ownership on land managed by numerous state and federal agencies. Federal land-managing agencies have produced a proliferation of regulations that are burdensome, often unnecessarily complicated, and sometimes contradictory (Appendices M-O). These regulations also pose unnecessary legal complications; for example, a paleontologist following an outcrop of rock may cross an unmarked boundary between Bureau of Land Management and Forest Service lands and thus be subject to an abrupt change in applicable regulations and/or guidelines, some of which may carry severe penalties for infractions including fine and arrest (Appendix L).

The Committee attempted to examine the full spectrum of problems related to the collecting of fossils. These include the possible impact of land development on the availability of fossils and the effects of fossil collecting on other aspects of land use. We have developed recommendations applicable to private and public lands and have considered the needs of professional research paleontologists and other scientists who use data obtained from fossils and the needs of hobby and commercial collectors.

2. PALEONTOLOGY AND FOSSIL COLLECTING

Paleontology is the study of fossils, the recognizable remains and traces of once-living, nonhuman organisms that are incorporated into the Earth's rocks. Shells, bones, leaves, tracks, trails, and a variety of other remains constitute a record of the history of life on the planet. Fossils are the focus of interdisciplinary study by geologists and biologists because fossils provide the basic data for evolutionary studies, measurement of time in Earth history, and the understanding of ancient environments and geographies. The research activities of paleontologists span the spectrum of effort from paleobiology to the application of data from fossils to the solving of geological problems.

Paleontology and Society

Fossils and fossil collecting serve a number of overlapping uses in our society. Fossils provide the only direct means of documenting the history of life on the Earth. Countless millions of species of plants and animals have evolved and become extinct in the known 3.5 billion years of the history of life on our planet. Paleontology is dedicated to exploring and studying this record. Knowledge of past life has a profound impact on many aspects of human inquiry, religion, and philosophy; only with this knowledge, can we attempt to place our own existence in a perspective of time and space in relation to our planet and the universe.

Of more day-to-day consequence to society is the use of fossils to establish a relative time scale of the physical history of the Earth. Fossils are found in a definite succession in sedimentary and slightly metamorphosed rocks, and fossils form the basis for the extremely detailed geologic time scale developed over the past 190 years (Appendix F). This geologic time scale is used on a daily basis by scientists studying the Earth and by the petroleum and mineral industries for prospecting, exploration, and mapping the distribution of rocks. Isotopic dating techniques calibrate the paleontologically determined geologic time scale in terms of years.

However, fossils remain basic to the description and measurement of the physical history of the Earth. Although the petroleum industry does not ordinarily use isotopic dating, it cannot function without paleontological dating.

At the federal level, paleontological expertise is housed primarily in the U.S. Geological Survey of the Department of the Interior. Because the Geological Survey does not manage land, it could act as the coordinator for all geological and paleontological advice to the diverse interests in the federal land-managing agencies. Additionally, all states have geological surveys, and most of these have established working relationships with universities, the U.S. Geological Survey, and other federal agencies.

Most professional paleontologists in the United States are organized into various societies (Appendix G). Membership in these societies is open and crosses all employer organization boundaries. The societies publish a variety of scientific papers in their journals, hold annual meetings, and function as the major media for exchange of information among paleontologists.

Fossils have educational value. Students at all levels are interested in dinosaurs and other extinct creatures. However, the significance of fossils in education extends well beyond an occasional trip to a museum or watching an educational television film. In the classroom, or on a field trip to collect fossils, handling and examining fossils are vital parts of both a general education in natural history and specialized training in paleontology, geology, and biology.

Thousands of ardent amateur collectors of fossils derive enjoyment from collecting trips, such as described in Appendix I, and these collectors have elaborate worldwide networks for trading and selling fossils. Many clubs and societies of amateur and hobby paleontologists exist in the United States (Appendix H), and some professional societies have large numbers of amateurs as members (Appendix G). There are many rockhound dealers and gem and mineral clubs worldwide, and many of these cater to amateur or hobby paleontologists. Shows at which fossils are sold or traded are held in Australia, Belgium, Canada, France, Italy, Holland, Spain, Switzerland, the Federal Republic of Germany, the United States, and many other countries.

Significant contributions to paleontology have been made by amateur fossil collectors who were curious and interested enough to share chance discoveries with professional paleontologists. Even in richly fossiliferous rocks that are well known to researchers, amateurs have found new species or exceptional specimens that have led to important scientific advances. A number of rock formations are so sparsely fossiliferous as to seem of little potential scientific value were it not for amateur collectors diligently searching for new material. One example is the Mazon Creek biota of Pennsylvanian age in Illinois (Appendix I). The fossils from Mazon Creek provide a unique view of life in the coal swamps that occupied Illinois 300,000,000 years ago. However, the more important Mazon Creek fossils are so rare that few, if any, professional

paleontologists can justify the time and expense required to collect them. The cumulative efforts of amateurs collecting over many years have made important paleontological analyses of Mazon Creek possible. Paleontologists at the Field Museum of Natural History in Chicago have fostered amateur-professional cooperation in the study of Mazon Creek fossils. Many other examples of amateur-professional cooperation could be cited.

To many people, the purely esthetic quality of fossils is important, and they use fossils for decorative purposes as objects of art. Periodically, fossils come into vogue in interior decorating. The esthetically pleasing patterns of fossils that dominate many polished marbles are widely used by architects for interior and exterior facing stone.

Fossil Collecting

Most fossils are relatively small (less than three inches long) and are collected either by picking up loose specimens on weathered rock surfaces or by using simple hand tools such as hammers, chisels, pry bars, and rakes. In poorly consolidated rocks, sieving of sediment is a common method of obtaining fossils. Quarrying to obtain fossils is generally limited to special situations where a locality is known to be fossiliferous and where the fossils are of special scientific or economic interest. Most such sites involve fossil vertebrates, and quarrying generally follows surface discoveries. Quarrying is expensive and ordinarily requires weeks or months to complete.

During field work, a paleontologist makes judgments as to which specimens to study. Once these judgments are made, selected specimens are removed for preparation and study in the laboratory. Collecting is obligatory if a fossil is to be of scientific or educational value. After specimens have been moved to the laboratory, their informational and predictive values are enhanced by various mechanical and chemical preparation techniques. The fossils are retained for future study and reference. In view of what must be done to make specimens of fossils scientifically useful, leaving specimens unprotected in their natural setting is not sensible. Fossils left behind are eventually destroyed by weathering and erosion.

Paleontology and Archeology

Attempts have been made by various federal agencies to regulate the collecting of fossils under statutes, or derived regulations, intended for archeological objects. This development is attributable to the misconception that paleontology is closely allied to archeology in its methods, objects of study, and goals.

Paleontology is the study of prehistoric, nonhuman life and is most closely allied with geology and biology. Archeology is a subdiscipline of anthropology and is often confused with paleontology. Archeology deals with the remains of past human

populations; it is the systematic study of antiquities and is limited to the materials produced by mankind. Paleontology has developed techniques and procedures different from those of archeology, and the nature of paleontological collecting and the uses of collections are very different from those of archeology.

Archeology focuses on the cultural history of Homo sapiens. This history is usually measured in thousands of years, whereas paleontology deals with the history of life dating back 3.5 billion years. In the Old World, paleontological and archeological scales sometimes overlap because the history of the humans there dates back several million years.

Archeology deals with the products of human activity and includes a broad spectrum of materials that range from arrowheads to pyramids, to ruined cities, and human bones. Because these remains are continuously exposed to weathering and erosion, and because until the industrial revolution comparatively few human beings lived on the Earth at any one time, archeological materials are comparatively rare. Justifiably, all the remains and works of ancient peoples are regarded as having special value, and specific rules for their collecting and/or preservation are appropriate. However, paleontologists do not consider all fossils extremely valuable because the Earth's outer crust contains trillions of them. This very abundance permits the use of fossils to establish a chronology of Earth history through the last 600,000,000 years by using the methods of biostratigraphy. As noted elsewhere in this report, the process of assigning special scientific significance to some fossils, and not to others, is based on knowledge, experience, and judgment. Therefore, paleontological specimens must be treated differently from archeological materials.

Removal of archeological materials, be they tools, pottery, or dwellings, can diminish, or even destroy, the value of the site for future study. Often, sites are best preserved intact and in situ. Archeology is highly site specific, and inventories of varying scale are appropriate to the science. Paleontology is rock-formation specific, and large-scale inventories are generally not practicable. Proper scientific collection of fossils insures their preservation for future generations of scientists and for educational purposes. With some important exceptions, collecting does not foreclose use of the rock formation for future study or as a source of additional fossils.

The archeological excavation method using a system of grid units is seldom used in paleontology and then only in special situations that require a record of the placement of the individual bones or shells.

Commercial Collecting

An industry of commercial fossil dealers has been a part of American paleontology for more than 100 years. Among primary dealers, the estimated 1985 gross income was $3,000,000. Dealers do primary collecting and also buy from and trade fossils with other

dealers and hobby collectors in the United States and elsewhere. Dealers sell to private individuals, schools, colleges, and museums. Many fossils now on display in museums were obtained this way. The dealers have formed the American Association of Paleontological Suppliers, which has a stringent code of ethics and acts as an oversight group for the business (Appendix J).

The trading, buying, or selling of common fossils often fulfills an educational need. In fact, many museums have funds set aside to purchase unique, unusual, or rare fossils. However, an antagonistic relationship has developed between research paleontologists and the commercial dealers. Almost every professional macropaleontologist has had the experience of seeing an exceptionally well-preserved and/or rare specimen serving as an ornament or priced so high that it could not be purchased for research or educational purposes, even though it may have been offered first to the professional community.

Paleontological field work is commonly seasonal and often requires several years to complete. Furthermore, a paleontologist may not be able to obtain funding for field work on a successive annual basis. Because localities may not be continuously collected and because they are difficult to police, some accumulations of scientifically valuable fossils are quarried away by dealers who later sell them before a paleontologist can finish gathering the basic data. This problem seems most acute in the field of vertebrate paleontology on western public lands. Most vertebrate paleontologists who spoke to the Committee felt strongly that fossils from public lands should remain public property. A written poll submitted to the members of the Society of Vertebrate Paleontology upheld this viewpoint. The antipathy toward commercial collectors is most strongly held by members of this Society.

The problem is not limited to vertebrate fossils on western public lands. For example, some years ago, a graduate student studying Ordovician trilobites in southwestern Ohio discovered a mass accumulation of these fossils. They were present in an unusual growth series, and the student planned to collect sufficient specimens to conduct statistical studies for his thesis. However, the location of the site became known, and local collectors quarried away the trilobites and sold them to a supplier who was not aware of the student's interest. The student was not able to complete his research, and important scientific information was lost.

Are Fossils Rare?

Fossils are not rare. The rocks of the Earth contain trillions of fossils. However, this statement needs qualification. To a large extent, the environment in which organisms lived determines whether the rocks formed in that environment will contain abundant fossils. Fossils are generally most common in rocks formed in relatively shallow marine waters. In this environment, storm waves can pile up shelled bottom-dwelling organisms by the millions. After a storm, the shells are covered by sediment, the animals commonly die, and shell beds several feet thick may form. The fossil record is highly

biased toward shelled organisms that lived in shallow marine environments. However, no matter what the environment, any extinct species that are represented by only a small number of individuals when alive will not be abundant in the fossil record.

In freshwater environments, fossils of animals are usually most abundant in rocks formed in lakes; such rocks may also be rich in the leaves, spores, and pollen of plants. Fossils found in rocks formed in streams and rivers tend to have patchy distributions. However, when found, such deposits of fossils may have large accumulations of bones, plant parts, and shells.

Fossils tend to be least abundant in rocks that formed on dry land because dead plants and animals ordinarily are exposed to the air for long periods of time. The flesh is eaten by scavengers, or it decays, and the bones are disarticulated and broken up. In East Africa, for example, unprotected long bones of modern animals are no longer recognizable after 10 to 15 years because of weathering and erosion.

Microfossils, such as diatoms, pollen, radiolarians, conodonts, many foraminifers, etc., can be so numerous that they often constitute nearly 100 percent of the rock containing them. Despite the foregoing generalizations, the abundance of fossils varies greatly both geographically and geologically, and no categorical statements can be made about their availability and potential importance to science. Vertebrate fossils tend to be the least common. They often occur only as isolated bones and teeth. Skulls, whole skeletons, and concentrations of bones are found only occasionally. Plant fossils also are generally rare and fragmentary although they are present in localized concentrations more often than bones. Most commonly, the plant concentrations preserve particular parts of plants, such as petrified logs or leaf impressions. Shallow marine invertebrates that secrete external shells are the most common macrofossils. In many places, they are a major constituent of the rocks in which they are found and are frequently preserved as complete specimens.

Organisms lacking hard parts are represented by very few fossil specimens, and most of these are regarded as scientific treasures. The animal groups having hard parts that have many terrestrial species generally have the poorest fossil records; these include reptiles, mammals, birds, insects, and spiders. Animal groups having hard parts that have many shallow-water marine species usually have the best fossil records; these include sponges, corals, brachiopods, bryozoans, echinoderms, snails, clams, crustaceans, and fishes. Animal groups having many freshwater species that have hard parts have a fossil record intermediate between terrestrial and marine groups; these include snails, clams, and fishes. However, well-preserved freshwater fish fossils, represented by partial or complete specimens, are known from relatively few localities.

Some fossil species may be known from one or a very few specimens from a small geographic region. A classic example is Archaeopteryx lithographica, thought to be the oldest bird. Only six specimens have been found, and all were collected by amateurs within a few

miles of each other in Jurassic rocks of southern Germany. The predatory dinosaur Tyrannosaurus rex is known from many more specimens over a much larger area of the American and Canadian west. However, most of the specimens are isolated teeth and bones; only three fairly complete skeletons are known.

The rarity of a particular kind of fossil depends very much on what one means by the words 'particular kind.' For example, dinosaur bone fragments are a common constituent of many stream deposits of Mesozoic age; they are found on all continents and occur in rocks spanning more than 100 million years of geologic time. In many collecting areas, finding dinosaur bone fragments or even complete bones is not unusual or especially noteworthy. However, certain species of dinosaurs are known from only one or two localities.

Any reasonable and workable set of guidelines for paleontological collecting must accommodate the tremendous variation in quantity, quality, and areal extent of rocks containing fossils. Statements such as "Dinosaur collecting sites must be protected" are not scientifically defensible, although some dinosaur sites are truly important and deserve special recognition and protection. Differentiating between more significant and less significant localities takes considerable knowledge, judgment, and experience.

Do Fossils Constitute a Nonrenewable Resource?

In the sense that fossil specimens are the remains of long-dead organisms, they are not renewable. However, any single specimen is a representative of a species, and usually other specimens of that species can be found; in this sense, fossils are renewable. Because fossils are part of the rock in which they occur, they may be exposed to view by the natural processes of weathering and erosion. As a result, erosional landscapes such as coastlines, stream valley walls, cliff faces, and arid badlands are most likely to have exposed fossils and to offer the best possibilities for collecting.

Geologists classify rocks into formations depending on the rock type. Formations commonly occupy many square miles of the Earth's crust, vary in thickness, may or may not be exposed at the surface, and represent deposition under a particular set of environmental conditions. Because the distribution of organisms is controlled by environment, one can return to a formation again and again and usually find other specimens of a particular fossil species, providing that the species was not very rare originally.

Some kinds of formations yield new specimens more rapidly than others. Climate and rock type determine the rate at which new specimens become available from a formation. For example, in the wet eastern United States, limestone formations weather and erode rapidly and generally form the low regions in the landscape. In the dry western United States, limestones weather and erode slowly and form the high spots in the landscape.

An outcrop of rock can be temporarily depleted of fossils by collecting, but more specimens may be exposed by heavy rains, tides and waves, or a winter of freezing and thawing. Even in the desert

badlands of the West, erosion rates are very high during infrequent rains and new specimens are exposed with each storm. Furthermore, if one outcrop of a formation is depleted of fossils, paleontologists can usually examine other outcrops.

If a rock is well consolidated and resistant, and if weathering and erosion processes are minimal, new specimens may be exposed very slowly. In such situations, the first collector to discover an outcrop may reap the rewards of centuries of weathering and erosion. Subsequent collectors will find surface collecting less rewarding. However, even in this case, fragments of fossils will usually be present, and they indicate to the trained eye the location of subsurface specimens. Most of the collecting of larger vertebrates is done this way. A whole dinosaur skeleton exposed to view in the field is extremely rare. In a modern paleontological laboratory, the rock matrix surrounding specimens can be removed chemically or mechanically.

An irony of the natural renewal process is that once specimens of fossils are exposed at the surface of the Earth, they do not remain collectible for very long in most environments. If a collector does not remove them, nature will destroy the exposed fossils through weathering and erosion. In especially hard and resistant rocks, on the other hand, a fossil exposure may remain essentially intact for many years.

Fossil specimens cannot be called a "resource" in the usual sense of the word. Unlike some mineral resources, the supply of specimens of most fossil species is effectively inexhaustible. New specimens of most species are continuously being exposed by erosion and by man-made excavations, such as road cuts, building excavations, mining, and quarrying. For most species, the only process that can completely remove all specimens is the removal of the entire formation by erosion or by large-scale mining and quarrying.

There are, of course, exceptions to this general statement. Although the supply of most species is plentiful on a regional or global scale, individual localities can be and are destroyed or made inaccessible by urban development, flood control dams, construction of highways and airports, surface mining, and even over zealous collecting. This is a problem especially when the distribution of important fossils is naturally patchy, as in deposits of ancient streams and rivers.

Also, rocks from certain environments, such as deep sea sediments, are seldom preserved in the geological record; but when they are found, their fossils give us a rare glimpse of a previously unknown diversity of life. Occasionally, as in the case of the Cambrian Burgess Shale, very special conditions of preservation occur, yielding rare fossils of soft-bodied organisms.

Except for teeth and bone fragments, fossils of most terrestrial vertebrates are not common, and generally they have a patchy distribution in stream and river sediments. Such unusual fossils deserve special recognition by society and the scientific community.

3. LAND-MANAGEMENT PROBLEMS

Managers of public land are charged with the complex task of reconciling potentially competing uses of the land. In addition, managers may have statutory obligations to protect or preserve the public land and its resources. To fulfill these basic functions, land managers must have detailed knowledge of landholdings, be able to evaluate the importance or value of resources, and be able to assess the effects of development or other exploitation of the land.

Inventory

Assessment and inventorying of a particular resource are obvious and necessary tools for managing resources such as timber and grasslands. However, an accurate inventory of all fossils on a given parcel of land is exceedingly difficult, and usually impossible to make because the land may contain trillions of fossil specimens. Only relatively limited outcrops of rock are seen in valley walls, badlands, and various human excavations. In addition, the sample of fossils exposed in outcrops at any one time is ephemeral and may not adequately represent the fossil content of the rocks.

Paleontologists have been working since the time of Aristotle to describe and document the vast fossil record. To date, about 250,000 species of fossils have been found, named, and described. The distribution of most of these species in time and space is reasonably well known. However, the scientific literature is not likely to provide basic inventory information about the paleontology of any randomly chosen tract of land. This is comparable to the problem of inventorying living insects. The entomological literature may give a general idea of what species of insects might be found in a given area. Perhaps some collecting has been done in the area, but an accurate inventory of the thousands of insect species and many millions of specimens inhabiting a specific tract is not possible in a reasonable length of time, at reasonable cost. The paleontological situation is even more complicated because the fossils are embedded in rocks that may not be well exposed for examination at the land surface.

Suppose, for example, a land manager wishes to develop a comprehensive inventory of the fossils on a square mile of land in

the coal-rich folded Appalachian Mountains of western Pennsylvania. To do this properly would require extensive field studies by a team of scientists well versed in the kinds of rocks and fossils likely to be found. The team would include paleobotanists, invertebrate and vertebrate paleontologists, and micropaleontologists, sedimentologists, and geologists concerned with the history and development of structural basins. Drilling would be needed and possibly major quarrying. After collecting, months or years would be required in the laboratory, library, and museum to identify and document the collections. This kind of comprehensive inventory would call for an unreasonable and impractical investment of time and might not be particularly useful scientifically, because the fossils of the coal fields of Pennsylvania are already reasonably well known.

Reconnaissance paleontological surveys at lesser scales are possible and often useful. Such work is carried out regularly as part of the geological mapping programs of the U.S. Geological Survey and of state geological surveys. Sampling is usually limited to the more common and more accessible fossils and is carried out in areas that are geologically and paleontologically poorly known. Inventories of limited scope, particularly in areas where paleontological information is scanty, generally yield scientifically useful fossil specimens.

Assessing the Value of Fossils

The process of establishing the scientific value of a fossil is highly judgmental, and the adage "One man's trash is another man's treasure" holds true. Scientific value cannot be determined by a simple formula or by application of a predetermined set of criteria to be used by land managers and developers. Finding another Pleistocene bison bone in Idaho or another Carboniferous fern leaf in Illinois adds little to paleontologic knowledge. A single specimen providing data that alter geological or evolutionary interpretations is considerably more valuable to science than thousands of specimens that have little or no impact on theory. The value of specimens can change with time as new technologies are developed for examining specimens and as new theory is proposed for interpreting them. A specimen that has been in a museum drawer for 100 years can have more impact on theory than a newly discovered specimen. One cannot consult the daily newspaper to find the current price per ounce for fossils.

The scientific value of a fossil depends ultimately on what it adds to our knowledge of the history of life or of the physical history of the Earth, rather than on any easily codified assessment of value. The land manager or developer is almost never in a position to make a judgment of the scientific value of a fossil. However, on the basis of their experience with the land, land managers and developers may be in a position to recognize a discovery of unusual concentrations of fossils in the area where they work. However, the assessment of the scientific value of a specimen may not be possible in the field. Often a fossil must be moved from the field to the

laboratory, where the rock matrix can be removed and the specimen studied.

A fossil can have value other than scientific . A petrified log in the Cretaceous rocks of New Mexico can be extremely important to local residents because it represents the ancient history of the region. It can be justifiably treasured for this reason, although it may have little scientific value because such logs are common and because of the relatively poor preservation of the woody tissue. Similarly, a bison bone from Idaho and a fern leaf from Illinois can be used as important teaching tools for demonstrating paleontological principles and for giving students hands-on experience with fossils.

Impact of Fossil Collecting on the Land

Most fossil collecting is of material exposed by the natural processes of weathering and erosion or by excavations made for purposes other than collecting fossils. Surface collecting by itself has little, if any, environmental impact, unless a site regularly attracts many people. As already mentioned, most collecting sites are "renewable" annually through normal erosion and weathering.

Relatively few collecting sites involve quarrying or digging. Such sites are typically associated with collecting fossil vertebrates; however, even with vertebrates, only a tiny fraction of the potential sites is ever excavated. The Morrison Formation, famous for its dinosaur faunas, covers hundreds of thousands of square miles from Canada to New Mexico and Utah to Kansas. The number of potentially important sites vastly outnumbers the paleontologists, professional or amateur, able to carry out expensive and time-consuming quarrying operations.

The environmental impact of quarrying for fossils is limited to effects typical of any excavation. The environmental perturbations caused by fossil quarries are negligible compared to those caused by road building or surface mining, and, in most cases, paleontological quarries are obliterated by natural processes within a few years. The Committee recognizes that some limits should be placed on paleontological quarrying for such reasons as protecting livestock and endangered species.

Impact of Land Development on Fossil Collecting

No generalizations about the effects of land development on fossil deposits can be made. Although development may benefit paleontology, it sometimes has negative consequences.

Surface mining, highway construction, and other types of land development are a mixed blessing for the paleontologist. Land development can destroy or cover important fossil deposits. For example, the La Brea Tar Pits in Los Angeles are important to paleontology because of the wide variety of magnificent specimens of Ice Age mammals preserved there. The tar pits occupy a small area but, unfortunately, they have become largely inaccessible because of urban development.

Although similar examples can be cited, the La Brea situation does not represent the general case. Many fossil deposits are exposed and made accessible to collectors as a result of land development. Just as natural erosion exposes fossils, so does some human activity. A prime example is the excavation that often accompanies highway construction. In many regions, especially those having well-developed soils, the only chance a geologist or paleontologist has to see rock exposures is in man-made roadcuts. However, even these opportunities are commonly foreclosed by the subsequent grading and seeding of roadcuts and by land reclamation after strip mining.

Various governmental agencies have proposed or undertaken "mitigation" or "salvage" programs where surface mining, flood control projects, or other construction threatens to destroy or render inaccessible fossiliferous deposits. These programs are of two kinds. The first calls for a reconnaissance inventory. This is practical if undertaken on a limited scale, but may not be justified on a scientific basis. In a few instances, the possibility of significant scientific discovery, or salvage of well-preserved fossils, might merit modest funding but, in general, it makes little sense to engage professional personnel in complex or long-term projects without sound scientific rationale.

The second kind of salvage program involves either (a) paleontologists stationed on sites to collect specimens as they are uncovered or (b) a stipulation that a project must be interrupted in the event of a discovery of a "significant fossil." The use of explosives and/or heavy machinery substantially diminishes the possibility that scientifically useful specimens will be recovered in the process of excavation. Furthermore, large-scale earth-moving operations frequently create hazardous conditions, such as deep pits, steep slopes, and masses of piled loose rocks. Attempts at salvage under these conditions are generally not prudent. Moreover, the cost of shutting down a large construction or mining project is excessive. Salvage programs of this kind are generally impractical from scientific, economic, and safety viewpoints. They can be very productive when an excavation exposes a new, rich locality; but these occasions are not common enough to justify a general mandate for salvage operations on all excavations.

4. AN ASSESSMENT OF PALEONTOLOGICAL REGULATIONS

A number of federal and state agencies have tried to develop regulations that recognize the importance of fossil collecting on public lands (Appendices M-O). These attempts have been hampered by the extremely complex and subjective aspects of the problem. Also, agencies rarely have had the benefit of paleontological expertise. Special difficulties have arisen where regulations originally written for archeology have been applied to paleontology.

The Bureau of Land Management has proposed a scheme for classifying lands on the basis of their potential to yield fossils of scientific value (Appendix M). The basis for this classification is "the degree to which a particular geologic formation is known to contain fossils." The Committee finds this criterion unacceptable.

Locality, not geologic formation is the proper basis upon which to determine the paleontological value of land. Much of the Morrison Formation, for example, is paleontologically uninteresting even though some Morrison localities, such as Dinosaur National Monument and the Cleveland-Lloyd Quarry (Appendix K), are paleontologically spectacular. The land is innocent of paleontological significance until a paleontologist demonstrates otherwise.

Additional problems are associated with the complex legal history of the regulation of fossil collecting in the United States. The Committee has not attempted to resolve the basic conflicts that exist in the varying interpretations of statutes, but we have provided, in Appendix R, a general summary of the problem.

Most land-management policies and regulations relating to fossil collecting appear to share a number of basic assumptions. Some of the more important of these are:

(1) fossils constitute a valuable, nonrenewable resource;

(2) assessing the importance of the fossils existing on a tract of land is possible and desirable;

(3) the land manager has an obligation to inventory fossils;

(4) the land manager has an obligation to preserve and protect fossils in rocks wherever possible;

(5) collecting of fossils should be limited and controlled, with the general objective of minimizing the amount of collecting; and

(6) collectors should provide detailed plans before collecting and report their findings afterward.

The Committee has serious reservations about these general assumptions. However, the situation is by no means clear-cut. Some or all of the six assumptions are entirely reasonable when applied to specific fossiliferous localities. Few, if any, paleontologists would challenge the need to control collecting at an unusual deposit like the La Brea Tar Pits. And any experienced paleontologist could easily make up a list of a dozen or more such localities in other parts of the United States. In the case of national parks and monuments, the Park Service is obliged by statute to use special measures to protect and preserve fossils.

Problems arise, however, when the six assumptions are applied to the general case. In this broader context, the six principles take on quite a different cast, as follows:

1) Renewability of fossils. Fossil-collecting sites are typically "renewed" by the normal forces of erosion and weathering and by preparation of entombed specimens in the laboratory. To call fossils "nonrenewable" may be technically true, but in a practical sense, it is false for most species.

2) Assessment of importance. In a very real sense, the importance of a fossil is in the eye of the beholder. The scientific importance of fossils depends entirely on how they fit into the broader context of prior knowledge; this is virtually impossible to codify. Therefore, whereas valuations of importance may be desirable, they are extremely difficult, if not impossible, to implement.

3) Inventory. General inventorying of the fossil content of a large area of land is rarely practical or desirable. However, limited-scope inventories and surface predevelopment salvage can be scientifically useful under certain circumstances.

4) Preservation and protection. Most collectable fossils are on the surface and are subject to erosion and weathering. To leave these fossils in a natural state usually ensures their eventual loss. Most fossils have more scientific and educational value after they are removed from the rock, prepared, interpreted, and preserved by museums, universities, geological surveys, companies, and private citizens.

5) Minimizing collecting. Because the supply of fossils is rarely finite and because fossils are for all practical purposes renewable, there is no general justification for minimizing scientific collecting. The act of collecting fossils has value throughout the range of scientific and societal uses. However, it is the view of the Committee that commercial collecting on the public lands should be controlled by a permit procedure and carried out with thorough scientific oversight.

6) Planning and reporting by collectors to land managers. Some of the most scientifically and educationally important collecting results from reconnaissance exploration. Although many paleontological discoveries in the field are made by chance, paleontologists do not prospect randomly. Specific geological formations and general

geographic areas are selected on the basis of available stratigraphical and paleontological data, with the expectation of fulfilling particular research goals. Despite this planning, anticipating a specific locality where the work will be performed or the kinds and numbers of fossils that may be found is seldom possible. Reporting fossil finds is scientifically important because only through such reporting is our knowledge of the history of life, and of the Earth, meaningfully increased. The well established medium of scientific publication accomplishes this function, leaving only special instances where separate reporting to a land manager is justified. Thus, the only use of permits is to limit access to land.

5. CONCLUSIONS AND RECOMMENDATIONS

The Committee was faced with some difficult and controversial issues. Nevertheless, the ten recommendations given below (with annotations) constitute a strong consensus and they were approved unanimously by the full Committee on September 14, 1986.

Recommendation #1. A uniform national policy on paleontological collecting should be adopted by all federal agencies. Existing statutory authority is adequate for implementation of such a policy.

Recommendation #2. Each state should adopt a uniform paleontological policy for state-owned lands.

Recommendation #3. All public lands should be open to fossil collecting for scientific purposes. Except in cases involving quarrying or commercial collecting, collecting fossils on public lands* should not be subject to permit requirements or other regulation.

The Committee recommends the following procedures and definitions:

> *Reconnaissance Collecting: Requires no advance notice to any public land manager; no permit is required. Such collecting is a day or less at any one locality and involves surface collecting by hand tools.*
> *Extended Stay Collecting: Requires written advance notice to the land manager so that applicable rules can be known and followed;** no permit is required. Consists of surface collecting for more than one day by using hand tools.*

---

* Other than National Parks

**This procedure should be kept simple and fast to allow a collector to explore more fully a newly discovered exposure or an unexpectedly productive site.

Quarrying for Fossils: For this report, a paleontological quarry is defined as an excavation of greater than two (2) cubic yards initiated for the extraction of fossils. Collecting fossils by quarrying should be controlled by a permit procedure. Permit forms should be simple.

Recommendation #4. Fossils of scientific significance should be deposited in institutions where there are established research and educational programs in paleontology. These repositories will ensure that specimens are accessioned, maintained, and remain available for study and education. There is no justification for requiring that fossils be deposited in an institution in the same state in which they were found; such requirements discourage paleontological research.

Recommendation #5. Commercial collecting of fossils from public lands should be regulated to minimize the risk of losing fossils and data of importance to paleontology. Permit applications must be subject to review by paleontologists qualified to assess the projects' potential impact on related research programs. Applications must receive the endorsement of a paleontologist who is willing to supply guidance to the commercial operation. Specimens deemed to be of special scientific interest must be deposited in a public institution, such as a museum, college, or university.

Past experience has clearly shown that commercial collecting has both benefited and hurt paleontological research. Many unique and scientifically important fossils have been discovered and made available to science by commercial collectors. Conversely, there are documented instances of important fossils disappearing into private hands with no opportunity for scientific study. The Committee believes that a permitting procedure for commercial collecting that would ensure access to specimens by scientists would meet the needs of both the scientific community and commercial interests.

Recommendation #6. Private landowners should follow the guideline that commercial collecting of fossils be undertaken with thorough scientific oversight to ensure that the scientific usefulness of specimens is not impaired.

Recommendation #7. Blanket paleontological inventories, mitigation, or salvage activities should not be undertaken, funded, or required by government agencies as a routine part of environmental assessment, impact analysis, permitting, land management, or similar programs.

By facilitating the work of scientists, land managers and other agencies can take advantage of the most effective means of accomplishing inventory objectives, i.e., increasing knowledge of fossil distributions on public lands. Thus, surface paleontological collecting should be encouraged on all public lands, including Areas of Critical Environmental Concern, Research

Natural Areas, Wilderness Study Areas, and Designated Wilderness Areas. There is no need to conduct general paleontological inventories on all public lands. Land managing agencies should contact the U. S. Geological Survey and appropriate state geological surveys to determine the need for a reconnaissance survey or limited-scope paleontological inventory where land development is contemplated. Development includes among other things urbanization, surface mining, dams, airport, and highway construction. In order to avoid unnecessary conflict and work, agencies should make these contacts in the early stages of land use planning and decision making. The Committee sees no need for land managing agencies to produce "Paleontological Resource Sensitivity" maps such as that produced for the Province of Alberta (Appendix P).

Recommendation #8. Land managers or developers who require scientific guidance on perceived paleontological problems should initially seek advice from the U. S. Geological Survey, or appropriate state geological surveys, which in turn may wish to contact appropriate paleontological organizations.

Recommendation #9. The Department of the Interior, in cooperation with the professional paleontological community, should identify and evaluate potential paleontological localities of national significance (on both public and private lands) for designation as National Natural Landmarks (NNLs), pursuant to the existing National Natural Landmark Program administered by the National Park Service (36 CFR 62). [See Appendix Q.]

Designation of a paleontological NNL should be made by the Secretary of the Interior with the advice of a National Paleontological Advisory Committee, which should include representatives of the subdisciplines of paleontology, recommended by the Paleontological Society.
All such localities should remain open for collection of fossils by the scientific community and by collectors commissioned by recognized educational and scientific institutions.
All such NNLs should be limited to the smallest area necessary to achieve their intended purpose.
Any individual or group may propose a fossil locality for designation as an NNL.
Type sections of rock formations and type localities of species are working tools for field stratigraphers, sedimentologists, paleontologists, and other scientists. Type sections and type localities should not for that reason alone ordinarily be designated National Natural Landmarks.

Recommendation #10. The paleontological societies of the nation should develop permanent and broadly based educational programs to inform landowners and commercial and amateur collectors of the research needs of professional paleontologists.

APPENDIX A

COMMITTEE MEMBERS, COMMITTEE STAFF, LIAISON MEMBERS, AND CONSULTANTS

Committee Members

CRAIG C. BLACK - Los Angeles County Museum of Natural History, Los Angeles, California (Vertebrate Paleontologist)

SANDRA L. BLACKSTONE - University of Denver, College of Law, Denver, Colorado (Attorney; former Deputy Director, Bureau of Land Management)

HOLLIS M. DOLE - Lake Oswego, Oregon (Geologist; former State Geologist of Oregon; former Assistant Secretary, Department of the Interior)

STERLING GROGAN - Utah International, Inc., Fruitland, New Mexico (Manager of Environmental Quality, Navajo Mine)

FARISH A. JENKINS, Jr. - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (Vertebrate Paleontologist)

PETER L. LARSON - Black Hills Institute of Geological Research, Hill City, South Dakota (Geologist; dealer in fossils)

JOHN POJETA, Jr., - U.S. Geological Survey, Washington D.C. (Invertebrate Paleontologist)

DAVID M. RAUP, Chairman - University of Chicago, Chicago, Illinois (Invertebrate Paleontologist)

PETER ROBINSON - University of Colorado Museum, Boulder, Colorado (Vertebrate Paleontologist)

CHARLES E. ROYBAL - New Mexico Department of Energy and Minerals, Santa Fe, New Mexico (Attorney, Deputy Secretary of Department)

J. WILLIAM SCHOPF - University of California, Los Angeles, California (Paleobotanist)

FRANCIS G. STEHLI - University of Oklahoma, Norman, Oklahoma (Invertebrate Paleontologist)

DONALD L. WOLBERG - New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico (Vertebrate Paleontologist)

Committee Staff

ROGER D. K. THOMAS - Franklin and Marshall College, Lancaster, Pennsylvania (Invertebrate Paleontologist)

WILLIAM E. BENSON - National Research Council, Washington D.C. (Geologist)

JOSEPH W. BERG - National Research Council, Washington D.C. (Geologist)

Liaison Members

A. PERRY - Office of Surface Mining, Department of the Interior

CARL BARNA - Bureau of Land Management, Department of the Interior

JOHN LANCE - National Science Foundation

GEORGE KOLSTAD - Department of Energy

FRED A. NELSON - Atlantic Richfield Foundation

CHARLES M. McKINNEY III - National Park Service, Department of the Interior

B. B. HANSHAW - U. S. Geological Survey, Department of the Interior

Consultants

MATTHEW N. MILLENBACH, STEPHEN L. FOSBERG, BARBARA am ENDE, LARRY MIRKES, MARCIA PETTA, RON FELLOWS, MICHAEL O'NEIL, DENNIS UMSCHLER, and EDWARD HEFFREN - Bureau of Land Management, Department of the Interior

A. GORDON EVERETT - American Institute of Professional Geologists

NORMAN F. SOHL - U.S. Geological Survey, Department of the Interior (1985-1986 President, Paleontological Society)

M. J. NOVACEK and R. HUNT, Jr. - Federal Liaison Committee, Society of Vertebrate Paleontology

Governing bodies of the Paleontological Society, Paleontological Research Institution, and Society of Vertebrate Paleontology

APPENDIX B

MEETINGS HELD BY THE COMMITTEE

April 22-23, 1985: Washington, D.C.

August 18-19, 1985: Washington, D.C., with a field excursion to fossiliferous localities in Calvert County, Maryland.

October 12-14, 1985: Farmington, New Mexico, with field excursions to the Navajo Mine and Fossil Forest.

January 31-February 1, 1986: Washington, D.C.

May 2-3, 1986: Cambridge, Massachusetts

September 13-14, 1986: Los Angeles, California

APPENDIX C

PUBLIC ANNOUNCEMENTS OF COMMITTEE ACTIVITIES

The Committee has taken a number of actions to encourage the paleontological community, both professional and amateur, to make suggestions and comments on the problems of fossil collecting. We have maintained close contact with the governing bodies of two professional organizations: the Paleontological Society and the Society of Vertebrate Paleontology. Also, general announcements of the Committee's activities were made at the annual meetings of both societies. In addition, broad appeals for input were published; five examples are given here.

PS-PRI NEWS
volume 3, number 2, 1985
A joint publication of the Paleontological Society
and the Paleontological Research Institution

NAS-NRC COMMITTEE ON GUIDELINES FOR PALEONTOLOGICAL COLLECTING

On April 22-23, 1985, the NAS/NRC Committee on Guidelines for Paleontological Collecting held its first meetings in Washington, D.C. The Committee is an outgrowth of discussions held by various ad hoc groups of paleontologists, and others, about surface disturbances and paleontology. A meeting held by the New Mexico Bureau of Mines and Mineral Resources in Farmington, in 1981, acted as a catalyst that led to the NAS/NRC Committee. The Committee acts under the auspices of the National Research Council; Commission on Physical Sciences, Mathematics, and Resources; Board on Earth Sciences. Part of the charge to the Committee is to develop "...valid scientific criteria for determining the significance of paleontologic resources..." and producing a report that "...should be of use to regulatory agencies at all levels of government, land managers and legal workers; corporations involved with any sort of development; research workers; and scientific societies." The Committee is very aware of the differences between paleontology and archaeology. The term of the Committee is through June 30, 1987.

Members of the Committee are: D. M. Raup, Chairman, University of Chicago; C. C. Black, Los Angeles County Museum of Natural History; Sandra Blackstone, University of Denver College of Law; Hollis Dole, retired, Lake Oswego, Oregon; Farish A. Jenkins, Jr., Harvard University; John Pojeta, Jr., U.S. Geological Survey; Peter Robinson, University of Colorado Museum; Charles Roybal, New Mexico Energy and Minerals Department; J. William Schopf, University of California, Los Angeles; Frank G. Stehli, University of Oklahoma. Staff to the Committee are: Joseph W. Berg, Jr., Board on Earth Sciences, NRC; William E. Benson, Board on Earth Sciences, NRC; Roger D. K. Thomas, Franklin and Marshall College.

The Committee plans to add members from the industrial, commercial, and hobby communities. Liaison members to the Committee include R. Z. Poore, U.S. Geological Survey; Carl Barna, U.S. Bureau of Land Management; and Al Perry, U.S. Office of Surface Mining. Various other persons from the professional communities will be invited as Liaison or Guest Members to advise the Committee. The Committee will meet in mid-August in Washington, D.C. and in mid-October in Farmington, New Mexico.

The Committee welcomes both written and oral comments from all interested persons. Any written comments should be sent to D. M. Raup, Chairman, Department of Geophysical Sciences, University of Chicago, 5734 South Ellis Ave., Chicago, IL 60637.

THE FUTURE OF FOSSIL COLLECTING ON PUBLIC LAND

by Peter L. Larson

Many of you have been following the controversy over who may and may not collect fossils on Public Land. You have watched several attempts by government agencies (such as the Bureau of Land Management) to promulgate regulations to define what may and what may not be collected. You have seen a Bill introduced in the United States Senate. Some of you have even written letters expressing opinions on how things should be handled. I would like to report on a new effort to gain a consensus among those people who are interested in paleontology, and particularly those people who actively collect fossils.

The National Academy of Sciences, Board on Earth Sciences, has formed a "Committee on Guidelines for Paleontological Collecting." This committee was established to study the problems involved with the collection of fossils from the Public Lands. Upon completion of this investigation, a report will be issued which is intended to provide guidance to the various land management agencies who are responsible for the management of our Public Lands.

The committee consists of representatives from various persuasions within the paleontological and geological community. In addition to scientists the committee has nominated individuals who are to provide input from private industry and the amateur community. I have been nominated to this committee and I would like you help.

In order for me to best fulfill my duties on the committee I need direct input from amateur paleontologists,. I would encourage each of you who are interested in the work of this committee to send comments or suggestions to the address listed below. Remember, this committee is considering questions related to Federal and Scientific policy for the collecting of fossils from your Public Land.

Peter L. Larson
Black Hills Institute
of Geological Research, Inc.
P.O. Box 643
Hill City, SD 57745

FOSSIL COLLECTORS: SPEAK OUT

Once again, the Bureau of Land Management is suggesting changes in the use of public lands that could affect your collecting privileges forever. That's why Lapidary Journal was pleased to discover that Peter Larson will be directly involved in a committee that will be communicating with "City Hall."

As June Culp Zeitner points out, "Peter Larson has worked for several years to explain the points of view of the amateurs and the industry to the White House, the Department of Interior, to Congress and others." So we are happy to print this message from Mr. Larson.

Many of you have been following the controversy over who may and who may not collect fossils on public land. You have watched several attempts by government agencies (such as the Bureau of Land Management) to promulgate regulations to define what may and may not be collected. You have seen a bill introduced in the U.S. Senate. Some of you have even written letters expressing opinions on how things should be handled. I would like to report on a new effort to gain a consensus among those people who are interested in paleontology, and particularly those people who actively collect fossils.

The National Academy of Sciences Board on Earth Sciences has formed the Committee on Guidelines for Paleontological Collecting. This committee was established to study the problems involved with the collection of fossils from the public lands. Upon completion of this investigation, a report will be issued which is intended to provide guidance to the various land management agencies who are responsible for the management of our public lands.

The committee consists of representatives from various persuasions within the paleontological and geological communities. In addition to scientists, the committee has nominated individuals who are to provide input from private industry and the amateur community. I have been nominated to this committee and I would like your help.

In order for me to best fulfill my duties on the committee, I need direct input from amateur paleontologists. I would encourage each of you who are interested in the work of this committee to send comments or suggestions to the address listed below. Remember, this committee is considering questions related to federal and scientific policy for the collecting of fossils from your public land.

Lapidary Journal encourages all who hope to use public lands in pursuit of their fossil collecting hobby to write to Peter L. Larson, Black Hills Institute of Geological Research, Inc., P.O. Box 643, Hill City, SD 57745.

Lapidary Journal, January 1986

Committee to set criteria

The Committee on Guidelines for Paleontological Collecting met for the first time April 22-23 in Washington, D.C., to discuss such topics as how artificial surface disturbances—strip mining, road construction—affect paleontology. Acting under the auspices of the National Research Council Board of Earth Sciences, the Committee sees the disturbances as a national problem.

Before the members' terms expire in June 1987, they will develop scientific criteria for determining the significance of paleontological resources, which will be used by many government regulatory agencies, land managers, legal officers, development corporations, research workers and scientific societies.

Members of the committee: chairman, D.M. Raup (University of Chicago); C.C. Black (Los Angeles County Museum of Natural History); Sandra Blackstone (University of Denver, College of Law); Hollis Dole (Lake Oswego, Oregon); Farish Jenkins Jr (Harvard); John Pojeta Jr (U.S. Geological Survey, Washington, D.C.); Peter Robinson (University of Colorado Museum); Charles Roybal (New Mexico Department of Energy & Minerals); J. William Schopf (University of California; Los Angeles); and F.G. Stehli (University of Oklahoma). The Committee plans to add members from industrial, commercial and avocational communities.

The staff includes J.W. Berg Jr (NRC/B.E.S.), W.E. Benson (NRC/B.E.S.) and R.D.K. Thomas (Franklin & Marshall College).

The committee welcomes comments. Write to D.M. Raup, Chairman, Department of Geophysical Sciences, University of Chicago, 5734 South Ellis Ave., Chicago, 60637.

APPENDIX D

COGNATE ACTIVITIES OF OTHER GROUPS

I. The present NAS/NRC Committee is an outgrowth of a series of meetings by interested groups of paleontologists, government officials, and representatives of industry. These meetings involved a number of people who were ultimately to become members of the Committee. The following meetings were of special importance in the development of the concept:

April 1981: Farmington, New Mexico. Because of developing problems associated with conflicts between the interests of paleontology and coal mining in northwestern New Mexico, a diverse group of interested parties met to address common problems. As an outgrowth of this meeting, the state of New Mexico produced a set of guidelines which represented a major step toward cooperative action for the state and private industry.

April 1982: Grand Junction, Colorado. As a follow-up to the Farmington meeting, a smaller group of paleontologists and industry personnel met to explore the larger problem of paleontological collecting.

February 1983: Los Angeles, California. Further discussion of the problem and formulation of a request to the National Academy of Sciences to establish a study group on paleontological collecting and its interactions with other aspects of land use.

December 1983: Boulder, Colorado. A tentative charge for the proposed NAS/NRC committee was developed, along with a list of suggested committee members.

The result of these deliberations was the official formation in mid-1984 of the Committee on Guidelines for Paleontological Collecting.

II. Society of Vertebrate Paleontology (SVP). The SVP has been active for a number of years with the general problem of the regulation of fossil collecting. The Government Liaison Committee of SVP has been and continues to be the focus of discussion and investigation of several aspects of fossil collecting, especially those having to do with the fossils of vertebrate animals. Michael J. Novacek is the current chairman of the Government Liaison Committee and he has worked closely with the NAS/NRC Committee. Furthermore, the NAS/NRC Committee membership includes several paleontologists who are or have been members of the SVP committee.

III. Geological Society of America (GSA). The GSA, operating through its Committee on Public Policy, convened a Panel on Access to Lands for Scientific and Educational Purposes under the chairmanship of Earl Cook. This panel met first on October 26-27, 1979, in Boulder, Colorado, and submitted a report in December, 1979. A second report was completed somewhat later and the panel became inactive.

IV. American Institute of Professional Geologists (AIPG). AIPG, with the support of the American Geological Institute (AGI), became involved in the access question following the GSA effort. An AIPG committee with the title "Access to Public Lands for Educational and Scientific Purposes" was appointed but became dormant. This committee has recently been reactivated under the chairmanship of A. Gordon Everett and has worked cooperatively with NAS/NRC Committee.

V. Paleontological Society (PS). The PS has long taken an active interest in the general problem of fossil collecting and its regulation. Especially noteworthy is a position paper adopted by the society on November 5, 1979, which covers many of the topics considered by the present NAS/NRC Committee.

APPENDIX E

GLOSSARY OF TECHNICAL TERMS

Unless otherwise indicated, definitions are quoted or modified slightly from Bates, R.L., and Jackson, J.A. (eds.), 1980, Glossary of Geology, 2nd Edition, American Geological Institute.

Amateur Paleontologist - The term "amateur" is used to designate those who do not make their full-time living from paleontology. (Journal of Paleontology, 1984, p. 278.)

Archeology - 1) The scientific study of the material remains of past human life and activities, such as fossil relics, artifacts, monuments, etc. 2) The materials of this science; the remains of the culture of a people; as the archeology of the Incas. (Webster's New Collegiate Dictionary, 1956, p.46, G. & C., Merriam Co. Springfield, Massachusetts.)

Biology - The study of all organisms, especially living ones; includes neontology and paleontology but most often is used to imply neontology alone. Neontology is the study of living organisms.

Biostratigraphy - Stratigraphy based on the paleontologic aspects of rocks, or stratigraphy with paleontologic methods; specifically the separation and differentiation of rock units on the basis of the description and study of the fossils they contain. See Stratigraphy.

Formation - A body of rock strata,...which is unified with respect to adjacent strata by consisting dominantly of a certain lithologic (rock) type or combination of types or by possesing other unifying lithologic (rock) features...

Fossil - The recognizable remains and traces of prehistoric, nonhuman organisms that are incorporated into the earth's rocks. (Defined in this report)

Geology - The study of the planet earth -- the materials of which it is made, the processes that act on these materials, the products formed, and the history of the planet and its life forms since its origin.

Isotopic dating - The application of the study of radioactive and stable isotopes, especially their abundances, to geology. It includes the calculation of geologic time.

Macropaleontology - The study of fossils (macrofossils) large enough to be seen with the naked eye. (Defined in this report)

Metamorphic rock - Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in the

solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the earth's crust.

Micropaleontology - The study of fossils (microfossils) that require magnifying equipment in order to be seen. (Defined in this report)

Outcrop - That part of a geological formation...that appears at the suface of the earth.

Paleontology - As used in this report, paleontology is the study of prehistoric, nonhuman life.

Sedimentary rock - A rock resulting from the consolidation of loose sediment that has accumulated in layers consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; a chemical rock formed by precipitation; or a rock consisting of the remains or secretions of plants and animals.

Stratigraphy - The science of rock strata. It is concerned not only with the original succession and age relations of rock strata but also with their form, distribution, composition, fossil content, geophysical and geochemical properties.

Type locality - The place from which the first specimens of a new fossil species are described. (Defined in this report)

Type section - The originally described sequence of strata that constitutes a stratigraphic unit or formation.

APPENDIX F

GEOLOGIC TIME SCALE

MODIFIED FROM U.S. GEOLOGICAL SURVEY BULLENTIN 1564, p. IV. 1986

Geological Time Scale					Age estimates of boundaries in million years (m.y.)	
Phanerozoic Eon	Cenozoic Era	Quaternary Period		Holocene Epoch	0.010	
				Pleistocene Epoch	2	(1.7-2.2)
		Tertiary Period	Neogene Subperiod	Pliocene Epoch	5	(4.9-5.3)
				Miocene Epoch	24	(23-26)
			Paleogene Subperiod	Oligocene Epoch	38	(34-38)
				Eocene Epoch	55	(54-55)
				Paleocene Epoch	63	(63-66)
	Mesozoic Era	Cretaceous Period		Late Cretaceous Epoch	96	(95-97)
				Early Cretaceous Epoch	138	(135-141)
		Jurassic Period			205	(200-215)
		Triassic Period			~240	
	Paleozoic Era	Permian Period			290	(290-305)
		Carboniferous Periods	Pennsylvanian Period		~330	
			Mississippian Period		360	(360-365)
		Devonian Period			410	(405-415)
		Silurian Period			435	(435-440)
		Ordovician Period			500	(495-510)
		Cambrian Period			~570	
Proterozoic Eon	Proterozoic Z				900	
	Proterozoic Y				1,600	
	Proterozoic X				2,500	
Archean Eon						
pre-Archean					(3800?)	
					4550	

APPENDIX G

ORGANIZATIONS OF PROFESSIONAL PALEONTOLOGISTS IN THE UNITED STATES

Eight major societies serve the profession of paleontology in the nation. Two of these, the Paleontological Research Institution and the Society of Economic Paleontologists and Mineralogists, have headquarters buildings and paid executive directors and staffs. The business affairs of the Paleontological Society are handled by a paid staff. The Society of Vertebrate Paleontology has a paid staff of bibliographers, and the Cushman Foundation for Foraminiferal Research has a paid part-time staff. However, most functions for most professional paleontological societies in the United States are carried out by volunteer paleontologists who earn their livings by working in academia, industry, government, or museums. Each paleontological society speaks only for its members through boards, councils, executive committees, and the like, which are elected to office by the members. No overall policy-making group exists for American paleontology. The Association of North American Paleontological Societies is a nascent umbrella organization of paleontological societies in the United States and Canada, which one day may have a council of representatives from each of the professional societies.

In addition to the eight major professional societies, a large number of other paleontological societies exist in the United States. By and large, these are either regional organizations, subdiscipline specialist organizations, or organizations of individuals who do not earn their livings as professional paleontologists.

The figures given below for the number of members of each professional society were obtained at various times in 1986. It is not possible to total the membership numbers and obtain an accurate figure for the number of professional paleontologists in the nation. Many paleontologists belong to more than one society, and some societies have significant numbers of amateur paleontologists as members. It is our best estimate that about 4,000 persons in the nation earn their livings as professional paleontologists: this number does not include various technical, photographic, secretarial, or other types of assistants. About 35 percent of American paleontologists work in industry or government, and about 65 percent work in academia or museums.

Except for the Paleontological Research Institution and the Society of Economic Paleontologists and Mineralogists, contact addresses listed

below for each society will change in the next few years as persons rotate into and out of various society positions.

The eight major professional societies are listed in the order in which they were founded.

(1) The PALEONTOLOGICAL SOCIETY is the oldest and largest professional organization of paleontologists in the United States, having been founded in 1908. The society has five regional sections, and publishes the Journal of Paleontology, Paleobiology, Paleontological Society Memoirs, Short Course Notes, Special Publications, and jointly with the Paleontological Research Institution, the PS/PRI Newsletter. Paleontologists in the United States belonging to the Society total 1,466, out of a worldwide membership of 1,850. About 75 percent of the membership is employed in academia and museums, and about 25 percent is employed in industry and government.

Contact address: John Pojeta, Jr., Secretary, Paleontological Society, c/o U.S. Geological Survey, Rm. E-501, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560. Telephone 202/343-5097.

(2) The SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS (SEPM) is a Technical Division of the American Association of Petroleum Geologists (AAPG). The SEPM was founded in 1926 by a group of micropaleontologists in the AAPG. The Society has several regional sections, and publishes the Journal of Sedimentary Petrology, Palaios, Paleontological Monographs, Short Course Notes, Workshop Notes, Field Guides, Abstracts, Special Publications, Reprints, and distributes Slide Sets. The Journal of Paleontology was founded by the SEPM in 1927, and was published jointly with the Paleontological Society from 1935 through 1985. The SEPM has a total membership of 7,469, of whom 5,744 live in the United States, and of these, 972 are classified as paleontologists. About 65 percent of the paleontologists in the SEPM are employed in academia and museums, and about 35 percent are employed in industry and government.

Contact address: Joseph R. Huffstetter, Executive Director, Society of Economic Paleontologists and Mineralogists, P. O. Box 4756, Tulsa, Oklahoma 74159. Telephone 918/743-9765.

(3) The PALEONTOLOGICAL RESEARCH INSTITUTION was founded in 1932. It publishes the Bulletins of American Paleontology, Paleontographica Americana, Special Publications, Reprints, and, jointly with the Paleontological Society, the PS/PRI Newsletter. Current membership of the PRI is 709, of whom 653 live in the United States. About 60 percent of the members are employed in academia or museums, about 30 percent in government or industry, and about 10 percent are amateur paleontologists.

Contact address: Peter R. Hoover, Director, Paleontological Research Institution, 1259 Trumanburg Road, Ithaca, New York 14850. Telephone 607/273-6623.

(4) The PALEOBOTANICAL SECTION of the Botanical Society of America was founded in 1936. The section publishes annually the Bibliography of American Paleobotany and a Newsletter. The section coordinates

paleobotanical activities with other paleontological, botanical, and geological organizations in the nation. It has 315 members, of whom 70 percent are employed in academia and museums and 30 percent in industry and government.
Contact address: Gar W. Rothwell, Secretary/Treasurer, Paleobotanical Section, B.S.A., c/o Department of Botany, Porter Hall, Ohio University, Athens, Ohio 45701. Telephone 614/594-5821.

(5) The SOCIETY OF VERTEBRATE PALEONTOLOGY (SVP) was founded in 1940. From 1934-1940, SVP was a section of the Paleontological Society. The SVP publishes the Journal of Vertebrate Paleontology, Bibliography of Fossil Vertebrates, Special Publications, and a News Bulletin. The Society has 1,225 members, of whom 919 live in the United States. About 60 percent of the members are employed in academia and museums, and 39 percent are amateur paleontologists: very few are employed in government or industry.
Contact address: D. P. Whistler, Secretary/Treasurer, Society of Vertebrate Paleontology, c/o Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, California 90007. Telephone 213/744-3445.

(6) The CUSHMAN FOUNDATION FOR FORAMINIFERAL RESEARCH (CFFR) was founded in 1950. It publishes the Journal of Foraminiferal Research and Special Publications of the Cushman Foundation. Membership in the CFFR is 305, of whom 195 live in the United States. About 50 percent of the members work in academia and museums, and about 50 percent work in industry and government.
Contact address: F. J. Collier, Secretary/Treasurer, Cushman Foundation for Foraminiferal Research, c/o Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560. Telephone 202/357-2405.

(7) The AMERICAN ASSOCIATION OF STRATIGRAPHIC PALYNOLOGISTS (AASP) was founded in 1967. It publishes Palynology, Contributions to Palynology, Special Books, Field Guides, Abstracts, and a Newsletter. The AASP has 898 members, of whom 479 live in the United States. About 50 percent of the members work in industry and government, and about 50 percent work in academia and museums.
Contact address: G. D. Wood, Secretary, American Association of Stratigraphic Palynologists, c/o Amoco Production Company, P. O. Box 3092, Houston, Texas 77253. Telephone 713/556-3380.

[8] The NORTH AMERICAN MICROPALEONTOLOGY SECTION (NAMS) of the SEPM was founded in 1977. NAMS publishes a Newsletter and Field Guides. The number of members is 344, of whom 323 are in the United States. About 60 percent of the members work in industry and government, and about 40 percent work in academia and museums.
Contact address: C. D. Blome, Secretary, North American Micropaleontology Section, c/o Paleontology and Stratigraphy Branch, U.S. Geological Survey, Mail Stop 919, Box 25046, Denver Federal Center, Denver, Colorado 80225. Telephone 303/234-2185.

1986 MEMBERSHIP IN PALEONTOLOGICAL SOCIETIES OF THE UNITED STATES
(Not all societies keep records for all categories of membership listed)

Society	Total	Foreign	Domestic	Amateur	Student	Professional
PS	1,850	384	1,466	*	139	1,327
SEPM	972		972	*	45	927
PRI	709	56	653	70	*	583
PS, BSA	315	*	315	*	60	255
SVP	1,225	306	919	358	144	417
CFFR	305	110	195	0	*	195
AASP	898		419	479	*	479
NAMS	344		21	323	*	323
TOTALS	6,618	1,296	5,322	428	388	4,506

On the basis of integrated mailing lists for the PS, PRI, and SVP, there is a 17 percent overlap in membership of those societies. 4,506 - 17 percent (766) = about 3,740 professional paleontologists in the United States who are member of the major professional societies.

APPENDIX H

ACTIVITIES OF AMATEUR PALEONTOLOGISTS IN THE UNITED STATES

Amateur or hobby paleontologists are active in large but probably uncountable numbers. As a group, the amateurs are a significant force in American paleontology. They belong to numerous clubs and other organizations which provide a medium for exchanging information, trading fossils, arranging collecting trips, and planning shows. Often, amateur paleontologists share interests with the much larger hobby groups concerned with gems and minerals.

As an indication of the size and scope of amateur activities in the United States, a list (surely incomplete) of local clubs specializing in fossils is included in this appendix. Because most hobby paleontologists belong to one or more of the broader-based gem and mineral clubs, we have also included a random page of a published list of "rockhound" clubs. The total list from which this page was drawn included 756 clubs, of which 517 publish bulletins or newsletters on a regular basis.

A substantial number of commercial dealers cater to the amateur fossil collector. As with the collectors themselves, dealers in fossils are often closely tied to the larger activities in gems and minerals. To give a sample of this, we have included a random page from a published list of "rockhound dealers." Some of these dealers buy and sell only gems and minerals but most handle fossils as well.

ORGANIZATIONS OF AMATEUR PALEONTOLOGISTS IN THE UNITED STATES
(partial list, arranged alphabetically by state)

OZARK EARTH SCIENCE CLUB - c/o Jean Zahner, Rt. 6, Box 206A, Mountain Home, Arizona 72653

SOUTHWEST FOSSILEERS - 4621 Panchoy Drive, LaMesa, California 92041

THE SOUTHERN CALIFORNIA PALEONTOLOGICAL SOCIETY - 4755 Baltimore St., Los Angeles, California 90042

THE FOSSILS FOR FUN SOCIETY, INC. - 931 El Dorado Way, Sacramento, California 95819

REDONDO BEACH MINERAL AND FOSSIL SOCIETY - P. O. Box 824, Redondo Beach, California 90277

PALEONTOLOGICAL SECTION - SAN DIEGO MINERAL & GEM SOCIETY - c/o M. Horensky, 1737 Maldon St., San Diego, California 92109

WESTERN INTERIOR PALEONTOLOGICAL SOCIETY - P. O. Box 211, Denver, Colorado 80220

BONE VALLEY FOSSIL SOCIETY - Bone Valley Museum, P. O. Box 371, Bradley, Florida 33835

GULF COAST MINERAL AND FOSSIL SOCIETY - P. O. Box 1404, Venice, Florida 33595

TAMPA BAY SCIENCE CLUB - P. O. Box 15176, Tampa, Florida 33684

LINCOLN ORBIT EARTH SCIENCE SOCIETY - c/o Wm. Zachary, New Berlin, Illinois 62670

THE CHICAGO AREA PALEONTOLOGY SOCIETY - Blue Island Community Service Center, 12812 S. Western Ave., Blue Island, Illinois 60406

GEOLOGICAL SECTION, PEORIA ACADEMY OF SCIENCE - c/o Chas. Eckhoff, R2 Box 191, Tremont, Illinois 61568

PALEONTOLOGY GROUP, EARTH SCIENCES CLUB OF NORTHERN ILLINOIS - Box 321, Downers Grove, Illinois 60515

PALEONTOLOGY DIVISION, EARTH SCIENCE SOCIETY OF NORTHERN ILLINOIS c/o John Catalini, 408 Justine Ave., Brookfield, Illinois 60513

THE MID-AMERICA PALEONTOLOGICAL SOCIETY (MAPS) - 2623 34th Ave. Ct., Rock Island, Illinois 61201

SOUTHERN ILLINOIS EARTH SCIENCE CLUB - c/o Joe Claxton, 1001 Wilshire, Mt. Vernon, Illinois 62864

WORTHEN EARTH SEARCHERS - c/o Hazel Kunz, 5 Deer Ridge, Quincy, Illinois 62301

DES PLAINES VALLEY GEOLOGICAL SOCIETY - c/o Wm. Zima, 420 Cordial Dr., Des Plaines, Illinois 60018

INDIANA GEOLOGY CLUB - c/o Florence Geisler, 3717 N. Riley, Indianapolis, Indiana 46128

INDIANA SOCIETY OF PALEONTOLOGY - Rt. 7, Box 199, Hwy 50E, Seymour, Indiana 47274

PALEONTOLOGICAL SECTION, VIGO ROC CLUB - c/o Dr. B. Moulton, RR 21, Box 103, Terre Haute, Indiana 47802.

MANHATTAN MINERAL AND FOSSIL SOCIETY - P. O. Box 958, Manhattan, Kansas 66502

FALLS OF THE OHIO FOSSIL CLUB - Louisville Museum of History & Science, Louisville, Kentucky 40220

OWENSBORO MINERAL AND FOSSIL CLUB - c/o Wm. Rogers, 26195 Cherokee Dr., Owensboro, Kentucky 42301

NATURAL HISTORY SOCIETY OF BALTIMORE - c/o A. Norden, 2623 N. Charles St., Baltimore, Maryland 21218

CALVERT MARINE MUSEUM FOSSIL CLUB - P. O. Box 97, Solomons, Maryland 20688

BEACON ROCK AND FOSSIL CLUB - c/o Stanley Luben, 13449 Cleveland Ave., Nunica, Michigan 49448

PALEONTOLOGICAL GROUP, MICHIGAN MINERALOGICAL SOCIETY - c/o Paul Rempes, Jr., 714 Lexington Blvd., Royal Oak, Michigan 48073

KALAMAZOO GEOLOGICAL SOCIETY - c/o Kitty Starbuck, 7636 "V" Ave. E., Vicksburg, Michigan 49097

EASTERN MISSOURI SOCIETY FOR PALEONTOLOGY - c/o Michael Fix, 10611 Jesskamp, St. Louis, Missouri 63136

PALEONTOLOGY DIVISION, MCDONNELL DOUGLAS MINERAL SOCIETY - c/o Ted Marikos, 11309 Birmingham Ct., St. Louis, Missouri 63138

PALEONTOLOGY SECTION, MINNESOTA MINERAL SOCIETY - c/o P. Richardson, 1066 Island Lake Ave., St. Paul, Minnestoa 55112

BIG SKY ROCK AND FOSSILS SOCIETY - P. O. Box 1383, Polson, Montana 59860

MONTANA SOCIETY OF NATURAL EARTH SCIENCES - Box 375, Bozeman, Montana 59715

MUSSELSHELL MINERAL & FOSSIL SOCIETY - P. O. Box 5025, Roundup, Montana 59072

THE BERGEN COUNTY MINERALOGY & PALEONTOLOGY SOCIETY, INC. - Paleontological Section c/o M. Stiller, P. O. Box 239, Rochelle Park, New Jersey 07662

THE MONMOUTH AMATEUR PALEONTOLOGY SOCIETY - c/o R. Johnson, 57 Oceanpoint Ave., West Long Beach, New Jersey 07764

THE NEW YORK PALEONTOLOGICAL SOCIETY - P. O. Box 287, Planetarium Station, 127 W. 83rd St., New York, New York 10024

GENESEE VALLEY FOSSIL SECTION - Rochester Academy of Science, Rochester, New York 14609

NORTH CAROLINA FOSSIL CLUB, INC. - P. O. Box 92, Cary, North Carolina 27511

PALEONTOLOGICAL DIVISION, LINCOLN MINERAL CLUB - P. O. Box 5342, Lincoln, Nebraska 68505

THE NORTH DAKOTA PALEONTOLOGICAL SOCIETY:
Bismark Chapter - c/o M. Brauer, R.R. 1, Box 53, Baldwin, North Dakota 58521
Minot Chapter - c/o Division of Science, Minot State College, Minot, North Dakota 58701

PALEONTOLOGY DIVISION, CINCINNATI MINERAL SOCIETY - c/o H. McClary, 3456 Fernwell, Cincinnati, Ohio 45231

DRY DREDGERS - Department of Geology, University of Cincinnati, Cincinnati, Ohio 45221

DELAWARE VALLEY PALEONTOLOGICAL SOCIETY - c/o Cindi Probst, 409 E. Belgrade St., Philadelphia, Pennsylvania 19125

PENNSYLVANIA EARTH SCIENCE ASSOCIATION - P. O. Box 2083, Lehigh Valley, Pennsylvania 18001

MYRTLE BEACH FOSSIL CLUB - Rt. 6, Box 269A, Conway, South Carolina 29526

BADLANDS SANDHILLS EARTH SCIENCE CLUB - c/o Neal Larson, HCR 59, Box 7, Mission, South Dakota 57555

ROSEBUD GEOLOGICAL SOCIETY - 410 Lamro, Winner, South Dakota 57580

AUSTIN PALEONTOLOGICAL SOCIETY - P.O. Box 15977, Austin, Texas 15977

PALEONTOLOGY SECTION OF THE HOUSTON GEM AND MINERAL SOCIETY - 5306 Pine Forest Road, Houston, Texas 77056

THE SOCIETY OF PALEOLOGGERS - 6202 48th Ave., East Tacoma, Washington 98443

COULEE ROCK CLUB - c/o Mary Boland, 2211 Valley Road, La Crosse, Wisconsin 54601

NEVILLE MUSEUM GEOLOGY CLUB - c/o Carol Anderson, 918 13th Street, Green Bay, Wisconsin 54304

PALEONTOLOGICAL DIVISION, WISCONSIN GEOLOGICAL SOCIETY - c/o L. Brown, 2446 N. 69th St., Wauwatosa, Wisconsin 53213

APPENDIX I

HOBBYIST COLLECTING AT MAZON CREEK, ILLINOIS

The attached article from Lapidary Journal (April, 1986) illustrates the enthusiasm with which amateur fossil collectors pursue their hobby. The article describes a trip, supported by the Sierra Club, to famous localities from which important 300-million-year-old fossils have been found. Current knowledge of these localities is due largely to the efforts of hobbyists.

Joyce Mori. "Floating for Fossils," Lapidary Journal, April 1986, pp. 60-62.

> Fossil collecting via canoe promises access to sites difficult to reach by land and the thrill--albeit at times excessive--of a river trip too.
> "Canoe and fossil hunt on the Mazon River," the Sierra Club newsletter beckoned. "The Mazon is a relatively clean waterway with some small rapids readily negotiable by the inexperienced canoeist....We will search for the renowned Mazon River Pennsylvanian fossils at certain locations along the river...."

The prospect intrigued me. The foliage fossils, as well as shrimp, trilobites, dragonflies and so on found in the ironstone concretions from the Mazon River area of Illinois are known worldwide and are prized by researchers and museums as well as private collectors. These 300-million-year-old fossils have given scientists an excellent knowledge of plant and animal life in the coal age forests.

Finally Outdoors Again

Winter had gone on forever, with early April bringing a big snow storm. We were more than ready for diversion. I had previously hunted successfully for Mazon fossils in the clay piles left from strip mines, but had always wanted to check out the river to which they owe their name. Perhaps the river would reveal new specimen types, or a greater abundance of nodules. For some time I had harbored the idea that a canoe would provide access to additional fossil and rockhound sites. Now I would soon be able to test that theory.

Although my family--husband, 14-year-old daughter and I--had canoed previously, we definitely belonged in the inexperienced category. When we assembled for the trip, we felt lucky to have fairly decent weather at 60° F with cloudy skies. The water level on the river was down again after the spring snows and heavy rains, but the water temperature was a chilly 40° F. Still, everything seemed calm enough.

At least 50 people arrived at the starting point, where Illinois Highway 113 crosses the Mazon River. Only a handful, though, were really interested in finding fossils; the others simply wanted to enjoy the canoeing. There was a pleasant hum of activity and excitement in the early morning air as we stood on shore waiting to launch our canoes. The area is very popular with canoe and kayak clubs, and plenty of craft dotted the river and its banks.

Into the Drink

Soon after entering the river, however,the rapids proved more of a challenge than I had expected. Large, partly submerged boulders loomed unexpectedly from the rushing waters and several canoes, ours included, lodged on the rocks, holding us in the swirling sprays. My husband swore, my daughter cried, and I just sat there! Finally, with fantastic help from some strong canoeists, we were pulled loose and quickly picked up the current again.

Another family wasn't as fortunate. Their canoe overturned twice! On the river was brisk--in the river: Ouch! On the whole, even though at times the canoeing was overly exciting, the trip was fun. But a word of caution: When exploring an unknown waterway, it's best to travel with another canoe, and always wear a personal flotation device.

Plentiful but Fragile Nodules

We visited three locations along the 6-1/2 mile section of river downstream from Rte. 113 that produced fossil bearing nodules. One was an excellent source. My theory about river expeditions proved correct: Good nodules were indeed more plentiful than on land.

When looking for fossil bearing nodules in strip mine tailings, it may take awhile to secure a number of nodules, where the action of frost and rain washes them out of the clay piles and exposes them to sight. However, along the river, nodules were found in layers of shale. They could be easily popped from the shale and clay matrix with a geologist's pick. On the clay hills, one generally finds one fossil in every 10 nodules. Along the river in a choice location, the ratio is much better. There, my average was four fossils per five nodules. In total, I collected more than 20 good specimens.

Though more plentiful than among the mine dumps, these nodules did seem more fragile as well. Perhaps the nodules along the river stay damper, due to occasional high water and drainage patterns. Be careful breaking these open. A gentle tap of the hammer along the nodule's edge is usually sufficient.

Plant fossils, too, were abundant on the trip. A half hour of hunting at one spot yielded a pleasant variety--blades of lycopod trees, seed ferns (pecopteris and neuropteris) and cyclopteris.

The outcroppings of shale along the creek containing the fossils are sharply vertical. The day of the trip, a slight drizzle produced a scattering of rivulets of water running down the sides, making the clay and shale treacherously slippery. With very little bank on which to stand, one had to take care not to slip right into the river! An extra pair of shoes left in the car is a good idea, giving the undaunted collector something dry to wear after the expedition and saving the car's interior from looking as if it too had gone collecting.

The trip took our group a total of about six hours, including a stop for a picnic lunch. Obviously, the experienced canoeists among us spent less time on the water, virtually no time in it, had fewer problems with rapids and shallows and could move faster along the river.

A Little Legacy

The morning after the trip as I tried to get out of bed to go to work, my legs were being most uncooperative. I tried to remember just how nice my fossil finds were, but it was a challenge. The soreness got worse. Putting on a jacket was pure agony. It took three days before my body could be persuaded that living was better than dying! Nonetheless, I am looking forward to exploring other sections of the Mazon and other rivers--though my husband has pronounced me a masochist.

Exploring a river via canoe is not easy. Two cars--one at the start and one at the finish--are necessary. Muscles must be in tune, or they will groan most discordantly. But the canoe does give one access to outcroppings and eroded areas not likely to be reached by land. The flooding of rivers continually serves to expose and erode new material much faster than many other agents, such as those at work in a quarry, for example. And since fewer collectors tend to be out in rivers and streams, specimens are more apt to be waiting to be found by those collectors who do venture out on the water.

APPENDIX J

AMERICAN ASSOCIATION OF PALEONTOLOGICAL SUPPLIERS

Businesses that deal in fossils have formed the American Association of Paleontological Suppliers (AAPS). The association was founded in 1978 and now has 29 members. The AAPS sets operational standards, to which members must subscribe to retain membership.

Contact: Neal Larson, Secretary/Treasurer
American Association of Paleontological Suppliers
Black Hills Institute of Geological Research
Box 643
217 Main Street
Hill City, SD 57745
605/574-4289

The AAPS constitution, including the association's Code of Ethics, and the 1986 AAPS membership list are attached.

CONSTITUTION OF THE

AMERICAN ASSOCIATION OF PALEONTOLOGICAL SUPPLIERS

Article I. Statement of Purpose

The purpose of the American Association of Paleontological Suppliers is to expand scientific knowledge and public awareness in the field of paleontology through preservation and distribution of paleontological remains. All materials collected for this purpose shall be obtained in an ethical and professional manner in order to preserve paleontological specimens otherwise lost to science by the destructive agents of weathering, and/or human endeavor. The economic objectives of the Association's members shall always reflect the desire to meet both the research and educational needs of the scientific community and the interested public.

Article II. Code of Ethics

All members of the American Association of Paleontological Suppliers will:

1. Stay informed of and comply with all Federal, State and Local regulations pertaining to collecting activities and general business practices.
2. Obtain permission from land owners or governmental authorities to gain access to collecting sites.
3. Obtain approval of Tribal as well as Federal authorities for access to lands wihtin Indian reservation boundaries.
4. Assure that all lands, properties, flora and fauna are left without damage to property or ecology as a result of collecting activities.
5. Take every precaution to guard against fire and remove all litter from study or collecting areas.
6. Encourage the use of safety procedures and protective equipment in potentially hazardous collecting areas.
7. Require that all fossil materials received from outside collectors are obtained in compliance with the above collecting guidelines set forth by the Association.
8. Report to proper local authorities any significant discoveries of scientific or public interest.
9. Strive to place specimens of unique scientific interest into responsible hands for study, research, and preservation.
10. Make no misrepresentation as to identity, locality, age, formation, repairs or restorations of paleontological specimens.

11. Conform to professional business practices when obtaining and disposing of specimens.
12. Maintain a good credit standing among fellow suppliers of earth science materials.
13. Encourage good relations and cooperation with agencies, institutions, and organizations actively involved in paleontological pursuits.

Article III. Membership

A) A Member shall be defined as a sole proprietorship, partnership or corporation engaged in the sale and distribution of paleontological remains. All members of the AAPS must agree to abide by the AAPS Code of Ethics.

1. Admittance to Membership

a. All prospective Members must be recommended by two AAPS Members in good standing.
b. All prospective Members must be approved by a simple majority vote taken by secret ballot at or before the annual meeting.
c. Membership dues must be paid annually.
d. Prospective Members must complete information forms supplied by AAPS.

2. Expulsion from Membership

Any Member that does not comply with the above requirements may be removed from membership by a two-thirds majority vote taken by a secret ballot at the Annual Meeting.

B. An Associate Member shall be defined as any member of the scientific community (professional paleontologist) with an active interest in cooperating with scientific commercial collectors for the purpose of advancing the science of paleontology. All Associate Members of AAPS must agree to abide by the AAPS code of ethics. (adopted October 1984)

1. Admittance to Associate Membership

a. All prospective Associate Members must be recommended by two AAPS Members in good standing.
b. All prospective Associate Members must be approved by a simple majority vote taken by ballot of AAPS Members at or before the annual meeting.
c. Prospective Associate members must complete information forms supplied by AAPS.

2. Expulsion from Associate Membership

a. Any Associate Member who does not comply with the above requirements, may be removed from membership by a two-thirds majority vote, taken by a secret ballot of Members at or before the annual meeting.

C. An Honorary Member shall be defined as an individual once engaged in the sale and distribution of paleontological remains who no longer relys upon the sale of fossils for full financial support. All Honorary Members of the AAPS must agree to abide by the AAPS Code of Ethics (adopted October 1984)

1. Admittance to Honorary Membership

a. All prospective Honorary Members must be recommended by two AAPS Members in good standing.
b. All prospective Honorary Members must be approved by a simple majority vote taken by ballot of AAPS Members at or before the annual meeting.
c. Prospective Honorary Members must complete information forms supplied by AAPS.

2. Expulsion from Honorary Membership

a. Any Honorary Member who does not comply with the above requirements, may be removed from membership by a two-thirds majority vote, taken by a secret ballot of Members at or before the annual meeting.

Article IV. Functions

Section A: Meetings

1. The Annual Meeting shall be held in conjunction with the Tucson Gem and Mineral Show.
2. Special Meetings may be called at any time by two or more officers.
3. Notification of official meetings shall be made in writing at least two weeks prior to meeting date.

Section B: Voting by Members

1. Each Member (firm) shall have one vote, to be cast by an appointed representative of that Member (firm).
2. Votes may be cast by secret ballot or by show of hands.
3. In case of a tie the decision shall be resolved by a consensus of the presiding officers.
4. Voting privileges are held only by Members engaged under Article III, Section A. (adopted October 1984)

Section C: Election of Officers

1. Election of officers shall be conducted during the Annual Meeting.
2. Officers to be elected shall be the President, Vice-President, and Secretary/Treasurer.
3. The term of office shall be one year.
4. Executive Board shall consist of the elected officers and four executive board Members to be elected at large at the annual meeting for a term of two (2) years. (adopted April 1984)
5. Nominations shall be selected from the valid representatives of the Member firms in attendance at the Annual Meeting. No officer shall be elected from any Member firm not represented at the Annual Meeting.
6. Nominees for each office shall be limited to no more than one third the number of Members represented at the annual meeting.

Article V. Duties of the Officers

The elected officers of the AAPS shall be the official spokesmen for the AAPS.

1. President: The President shall preside over official meetings and shall be responsible for the appointment of committees and spokesmen for special tasks.
2. Vice-President: The Vice-President shall assist the President and shall assume Presidential duties in the absence of the President.
3. Secretary/Treasurer: The Secretary/Treasurer shall be responsible for accurate minutes of official meetings and notification of meetings. The Secretary/Treasurer shall administer the funds of the AAPS.
4. Executive Board (Board of Directors): The Executive Board shall guide the activities of the AAPS, be responsible for reviewing all nominations for membership and conduct preliminary research into the current and pertinent legislative activities. (adopted October 1984)

Article VI. Provisions for Bylaws

Bylaws to this constitution shall be approved by a simple majority vote by Members present at any official meeting.

1. All new members must be proposed and seconded in writing to the secretary no later than Oct. 1 preceeding the Annual Meeting. A brief resume of the prospective member should accompany the proposal. (adopted Feb. 1980)
2. The secretary will forward a ballot to the membership with a brief resume of each prospective member. A response is

expected no later than two (2) weeks prior to the Annual Meeting. Failure to respond will constitute a vote for approval of each proposed member. (adopted Feb. 1980)

Article VII. Provisions for Amendments

Amendments to this constitution must be submitted in writing to the secretary at least two weeks prior to the Annual Meeting. Amendments must be approved by at least at two thirds vote of all members. Any vote not received within three months of the Annual Meeting shall be considered a No vote.

Article VIII. Provisions for Resolutions

Resolutions shall be approved by a simple majority vote by the Members. (adopted October 1984)

1. We as an organization highly recommend that any specimen of potential scientific importance which is collected as a positive and negative or as a "split" specimen should be kept together and dealt with as if one specimen. (adopted October 1984)
2. We as an organization hereby resolve that we will strive to guarantee that all scientifically important and/or potential type specimens will be brought to the attention of and made available for study to American Institutions by means of loan, donation, or sale before other means of dispersal are considered. (adopted October 1984)

AAPS AMENDMENT TO CONSTITUTION (adopted November 1982)

I. Incurement of income. No officer of AAPS shall take a wage for the execution of duties relating to the position by said officer.
II. Dissolution. Upon the dissolution of AAPS the funds shall be used to pay all debts and liabilities incurred by the AAPS. The remaining assets shall be donated to a said organization with the sole purpose of preserving the scientific aspects of free collecting of fossils and the recording of scientifically important specimens sold by the concerned commercial fossil dealers.
III. Legislative or Political Activities. The organization of AAPS shall not use any funds for the political campaign on the behalf of any candidate for public office. The only legislative purpose of the organization shall be to help provide free collecting of fossils on state and federal lands.
IV. Operational Limitations. The organization of AAPS shall not carry on any other activities not permitted to be carried on by a corporation exempt from Federal income tax under Section 501(c) of the Internal Revenue code of 1954 or by a corporation, contributions to which are deductible under Section 170(c)(2) of the Internal Revenue code of 1954.

1986 AAPS MEMBERSHIP LIST

Aurora Mineral Corporation, Harvey & Michael Siegel, Freeport NY
Baby Doe Mining Company, John & Leigh Hovanec, Wheatridge CO
Black Hills Institute of Geological Research, Inc.,
Neal & Peter Larson, Hill City, SD
Bonner, Marion (honorary), Healy KS
The Bug House, Loy Crapo, Delta UT
California Rock & Mineral, Anthony & Dolores Jones, Brea CA
Carolina Biological Supply Company, Richard S. Lovesy, Burlington NC
Crista-Galli, Toto & Lulu Olivera, Salt Lake City UT
Ehrle, Bud, Miles City MT
Fossil Fish Wholesale, Rick Jackson, Champlin MN
Geological Enterprises, Allen Graffham, Ardmore OK
Geoscience Enterprises, Bob Howell, Roachdale IN
Judy Owyang's Fossils Etc., Judy Owyang, Los Angeles CA
Lang's Fossils, Allan Lang, Cranford NJ
Larry Martin's Fossils, Larry Martin, Orlando FL
Maloney's Fossils, Larry Maloney, Willows CA
Natures Own, Roy Young, Nederland CO
Roger Welles, Knoxville TN
Pangaea Fossils, Roland A. Gangloff, Oakland CA
Warfield Springs Fossil Quarries, Inc., Rick & Gael Hebdon, Thayne WY
West Desert Collectors, Bob Harris, Delta UT

1986 AAPS OFFICERS

Gael Hebdon, President, Warfield Springs Fossil Quarries
Larry Martin, Vice President, Larry Martin's Fossils
Bob Farrar, Secretary/Treasurer, Black Hills Institute of Geological Research
Peter Larson, Science Officer, Black Hills Institute of Geological Research

1986 BOARD OF DIRECTORS

Roland Gangloff, Pangaea Fossils
Allen Graffham, Geological Enterprises
Peter Larson, Black Hills Institute of Geological Research
Rick Hebdon, Warfield Fossil Quarries

APPENDIX K

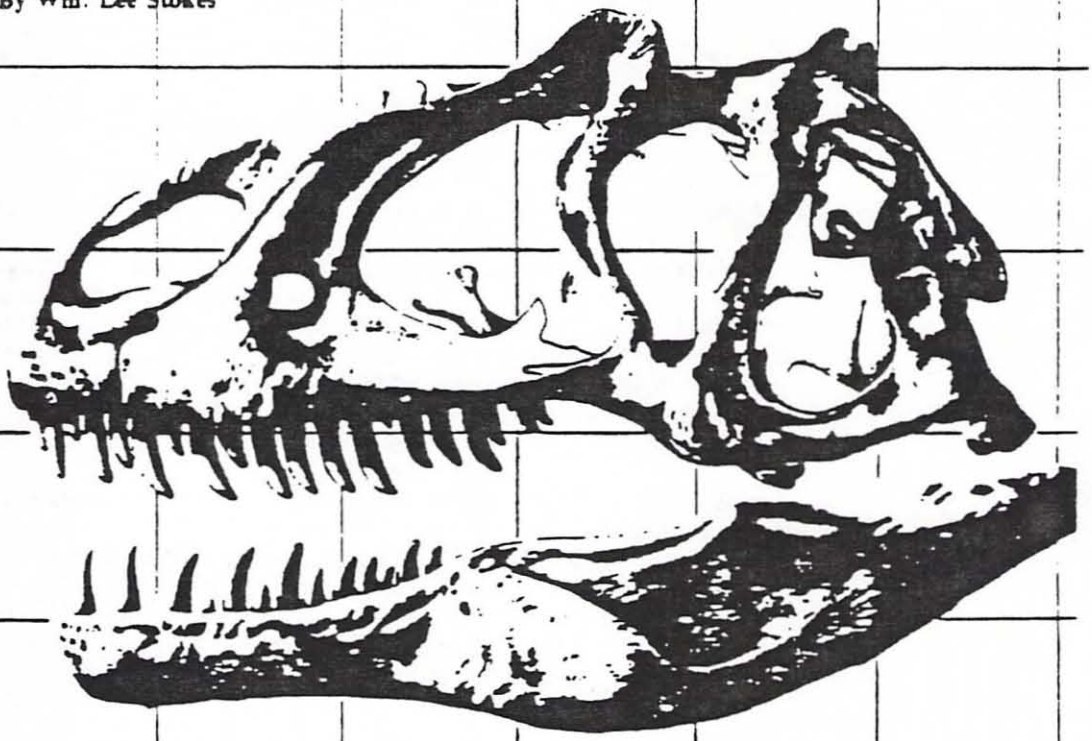
DISPLAY SPECIMENS OBTAINED FROM THE CLEVELAND-LLOYD DINOSAUR QUARRY

To obtain fossils for research and display, museums commonly either purchase them directly or commission their collection. The attached pages document one case of the latter method: the Cleveland-Lloyd Quarry. This quarry has been designated a National Natural Landmark because of its spectacular dinosaur fossils. A large number of museums in the United States and foreign countries arranged payment for the costs of collecting these fossils in exchange for display specimens. The collecting was done by faculty and students operating under a University of Utah cooperative project. No commercial collectors were employed.

THE CLEVELAND–LLOYD DINOSAUR QUARRY

WINDOW TO THE PAST

By Wm. Lee Stokes



Display Specimens

The Cleveland-Lloyd Quarry was not designated a U.S. natural landmark without ample reasons. It qualifies for the distinction because of the unusual number and variety of both exhibition and research specimens taken from it. Organized professional excavation yielded about 10,000 individual bones. From these bones more than 70 individual animals representing at least 14 species have been identified. This great profusion of remains has been the basis for more public exhibits than the products of any other dinosaur quarry on earth. Specimens for display were obtained chiefly through the University of Utah Cooperative Dinosaur Project whereby cooperating institutions received specimens in return for financial contributions. Recipients and the names of specimens received by them are listed below. A key to the notations following the institutional name includes: A - Allosaurus and the femur length giving size; C - Camptosaurus; c - cast specimen; o - original specimen in part; S - Stegosaurus; Ca - Camarasaurus.

Albuquerque Museum of Natural History, Albuquerque, New Mexico (No. 33A/c, C/c, S/c, Ca/c)
Brigham Young University, Provo, Utah (No. 30A/o, C/c)
Buffalo Museum of Science, Buffalo, New York (No. 25A/o)
Bureau of Culture Center, Kagashima, Japan (No. 22A/o, C/o)
U.S. Bureau of Land Management, Cleveland-Lloyd Dinosaur Quarry, Emery County, Utah (No.22A/o)
California Academy of Sciences, Golden Gate Park, San Francisco, California (No. 33A/o)
City of Liverpool Museum, Liverpool, England (No. 22A/c, C/c)
College of Eastern Utah Prehistoric Museum, Price, Utah (No. 27A/o, C/c, Ca/o, S/o)
Emery County Museum of Natural History, Castle Dale, Utah (No. 22A/c)
Exhibit Museum, Ann Arbor, Michigan (No. 30A/o)
Fort Worth Museum of Science and History, Forth Worth, Texas (No. 22A/o, C/c)
Brazosport Museum of Natural History, Freeport, Texas (No. 33A/c)
Museum of Western Colorado, Grand Junction, Colorado (No. 33A/c)
Hokkaido Centennial Office, Hokkaido, Japan (No. 33A/c)
Institute for Breeding Research, Tokyo University of Agriculture, Tokyo, Japan (No. 33A/c, C/c)
Joseph Moore Museum, Richmond, Indiana (No. 27A/o)
Los Angeles County Museum of Natural History, Los Angeles, California (No. 27A/o, C/o, S/o)
Mineral Research and Exploration Institute, Ankara, Turkey (No. 33A/c)
Ministry of Education, Kuwait, Arabia (No. 33A/c, C/c)
Museo Civico di Storia Naturale, Milano, Italy (No. 22A/o, C/c)
Museum d'Histoire Naturelle, Geneva, Switzerland (No. 33A/o, C/c)
Museum National d'Histoire Naturelle, Institute de Paleontologie, Paris, France (No. 33A/c)

Museum of Natural History, University of Wisconsin, Stevens Point, Wisconsin (No. 22A/c)
National Museum of Canada, Ottawa, Canada (No. 25A/o)
National Science Museum, Ueno Park, Tokyo, Japan (No. 27A/o, C/c)
Natural Science Museum, Cleveland, Ohio (No. 33A/o)
New England Paleontological Society, Barre, Massachusetts (No. 22A/c)
Osaka Museum of Natural History, Osaka, Japan (No. 33A/c)
Panhandle Plains Museum, Canyon, Texas (No. 33A/c)
Peabody Museum of Natural History, Yale University, New Haven, Connecticut (No. 22A/o)
Life Sciences Museum, Pierce College, Woodland Hills, California (No. 22A/c)
Louisiana State University, Baton Rouge, Louisiana (No. 33A/c)
Royal Ontario Museum, Toronto, Canada (No. 33A/o, No. 33A/c, C/o)
Royal Scottish Museum, Edinburgh, Scotland (No. 27A/o)
Saito Ho-on Kai Museum of Natural History, Sendai, Japan (No. 33A/c)
Science Museum, St. Paul, Minnesota (No. 22A/o)
Texas Technological College, Lubbock, Texas (No. 30A/o)
Thomas Burke Museum, Seattle, Washington (No. 25A/o)
Tyrrell Museum of Paleontology, Drumheller, Alberta. Canada (No. 33A/c, C/c, Ca/c, S/c)
University of Nebraska State Museum, Lincoln, Nebraska (No. 35A/o, No. 17A/o)
Vines Environmental Science Center, Houston, Texas (No. 33A/c)
Virginia Polytechnic Institute and State University, Blacksburg, Virginia (No. 22A/c)
Weber State College, Ogden, Utah (No. 22A/c, C/c).

APPENDIX L

CONFLICTS BETWEEN FOSSIL COLLECTORS AND GOVERNMENT AGENCIES

The relationship between government agencies and fossil collectors, both professional scientists and amateurs, has a long history of conflict and misunderstanding. In this appendix, we document a few cases and situations as examples of the general problem. The documents are drawn from hundreds studied by the Committee. They serve to illustrate the need for a standard approach to the problem.

December 23, 1981

Dr. Ruthann Knudson
Legislative Coordinator
Society for American Archaeology
Woodward-Clyde Consultants
Three Embarcadero Center, Suite 700
San Francisco, CA 94111

Dear Dr. Knudson:

Thank you very much for your letter of December 8, 1981, requesting verification and clarification of the 1974 incident in which officials of the Bureau of Land Management attempted to press charges against me under the Antiquities Act of 1906.

As is so often the case, most of the information availed to you about this matter is erroneous. I am only too happy to provide you with the correct details of the circumstances and outcome, for the Society of Vertebrate Paleontology, of which I am president this year, has been concerned for three decades over misapplication of antiquities legislation to paleontological activities. Other members of the Society and I have been actively engaged over the last five years in attempting to rectify the paleontological permitting system as well as a number of legal anomalies. I am surprised that you apparently did not seek information on this matter from Mr. Charles M. McKinney in the Department of the Interior. He would have acquainted you fully with the details of this and other similar cases.

I might begin by correcting errors in the story as it was passed on to you. My paleontological field area in 1974 was in Montana, not in Wyoming. I was not jailed nor did I make a personal appearance in court.

The brief summary of the incident is as follows: In 1974 a field crew from the MCZ, under my direction, was quarrying a locality on the "Edwards Ranch" near Bridger, Montana. The Edwards' were long my personal friends, and always freely granted permission to work the Cloverly Exposures on their land. Unknown to me, they had lost the lease to the land that year and a new ranch manager had taken over. It was he who called in BLM personnel without ever having met me personally (there apparently was antagonism between the Edwards and the new ranch manager). BLM personnel appeared in my camp but did not identify themselves. They simply expressed curiosity about our activities, and in my usual fashion, I explained the nature of our work and showed them the early Cretaceous fossils that we were recovering. They asked to take pictures of them, and I freely consented. Only then did they identify themselves as BLM personnel, claiming that although our camp was on deeded land, in fact our quarry was across an unmarked

boundary on BLM land. I expressed regret for this transgression, displaying all my maps and data, none of which indicated that I was on federally-leased land. The next day, I went to the regional office of BLM in Billings in an attempt to straighten the matter out, bringing with me all of my maps and data. This sincere attempt at cooperation turned out to be unwise, since all of the materials that I provided were subsequently used in preparation of the case against me.

I thought that the matter had been settled when I agreed to withdraw from the site pending receipt of a permit under the Antiquities Act of 1906, which I had never heard of. Subsequently, however, I received a warrant pressing charges (Enclosure #1). Despite personal discussions between Robert L. Zimmerman (Assistant U.S. Attorney), Daniel Steiner (General Counsel, Harvard University), and me, the government did not wish to drop the charges and the case proceeded. Our attorney moved for dismissal citing the case of the United States versus Diaz (Enclosure #2). The United States Attorney, on the other hand, maintained the claim that paleontological objects "thousands" (sic) of years old were still objects of antiquity (Enclosure #3); (the fauna of the Cloverly is approximately 100 million years old).

Doubtlessly you have read the opinion of the United States Court of Appeals for the Ninth Circuit on the Ben Diaz case. Should this not be available to you, I am enclosing a copy (Enclosure #4). It is abundantly clear to me, even without legal training, that the Federal government misapplied a well-intentioned law in both Mr. Diaz's case and mine.

United States District Judge James F. Batten, following the Ninth Circuit Court of Appeals ruling, dismissed my case (Enclosure #5).

All of us in the Society of Vertebrate Paleontology have continuing interest in formulating and supporting legislative actions that will protect paleontological resources and at the same time not prevent professional paleontologists from preserving and studying them. We continue to work closely with Mr. Charles N. McKinney of the Department of Interior on these matters, and I am of course grateful for your expression of interest and willingness to exchange information or assistance. I am particularly grateful to you for writing to the original source to obtain accurate information

With best wishes.

Yours sincerely,

Farish A. Jenkins, Jr.
Professor of Biology
Curator of Vertebrate Paleontology
(President, Society of Vertebrate Paleontology)

[PUBLIC—No. 209.]

An Act For the preservation of American antiquities.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

SEC. 2. That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected: *Provided*, That when such objects are situated upon a tract covered by a bona fide unperfected claim or held in private ownership, the tract, or so much thereof as may be necessary for the proper care and management of the object, may be relinquished to the Government, and the Secretary of the Interior is hereby authorized to accept the relinquishment of such tracts in behalf of the Government of the United States.

SEC. 3. That permits for the examination of ruins, the excavation of archæological sites, and the gathering of objects of antiquity upon the lands under their respective jurisdictions may be granted by the Secretaries of the Interior, Agriculture, and War to institutions which they may deem properly qualified to conduct such examination, excavation, or gathering, subject to such rules and regulations as they may prescribe: *Provided*, That the examinations, excavations, and gatherings are undertaken for the benefit of reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such objects, and that the gatherings shall be made for permanent preservation in public museums.

SEC. 4. That the Secretaries of the Departments aforesaid shall make and publish from time to time uniform rules and regulations for the purpose of carrying out the provisions of this Act.

Approved, June 8, 1906 (34 Stat. L. 225).

UNIFORM RULES AND REGULATIONS

PRESCRIBED BY THE SECRETARIES OF THE INTERIOR, AGRICULTURE, AND WAR TO CARRY OUT THE PROVISIONS OF THE "ACT FOR THE PRESERVATION OF AMERICAN ANTIQUITIES," APPROVED JUNE 8, 1906 (34 STAT. L., 225).

---

1. Jurisdiction over ruins, archeological sites, historic and prehistoric monuments and structures, objects of antiquity, historic landmarks, and other objects of historic or scientific interest, shall be exercised under the act by the respective Departments as follows:

By the Secretary of Agriculture over lands within the exterior limits of forest reserves, by the Secretary of War over lands within the exterior limits of military reservations, by the Secretary of the Interior over all other lands owned or controlled by the Government of the United States, provided the Secretaries of War and Agriculture may by agreement cooperate with the Secretary of the Interior in the supervision of such monuments and objects covered by the act of June 8, 1906, as may be located on lands near or adjacent to forest reserves and military reservations, respectively.

2. No permit for the removal of any ancient monument or structure which can be permanently preserved under the control of the United States *in situ*, and remain an object of interest, shall be granted.

3. Permits for the examination of ruins, the excavation of archeological sites, and the gathering of objects of antiquity will be granted, by the respective Secretaries having jurisdiction, to reputable museums, universities, colleges, or other recognized scientific or educational institutions, or to their duly authorized agents.

4. No exclusive permits shall be granted for a larger area than the applicant can reasonably be expected to explore fully and systematically within the time limit named in the permit.

5. Each application for a permit should be filed with the Secretary having jurisdiction, and must be accompanied by a definite outline of the proposed work, indicating the name of the institution making the request, the date proposed for beginning the field work, the length of time proposed to be devoted to it, and the person who will have immediate charge of the work. The application must also contain an exact statement of the character of the work, whether examination, excavation, or gathering, and the public museum in which the collections made under the permit are to be permanently preserved. The application must be accompanied by a sketch plan or

description of the particular site or area to be examined, excavated, or searched, so definite that it can be located on the map with reasonable accuracy.

6. No permit will be granted for a period of more than three years, but if the work has been diligently prosecuted under the permit, the time may be extended for proper cause upon application.

7. Failure to begin work under a permit within six months after it is granted, or failure to diligently prosecute such work after it has been begun, shall make the permit void without any order or proceeding by the Secretary having jurisdiction.

8. Applications for permits shall be referred to the Smithsonian Institution for recommendation.

9. Every permit shall be in writing and copies shall be transmitted to the Smithsonian Institution and the field officer in charge of the land involved. The permittee will be furnished with a copy of these rules and regulations.

10. At the close of each season's field work the permittee shall report in duplicate to the Smithsonian Institution, in such form as its secretary may prescribe, and shall prepare in duplicate a catalogue of the collections and of the photographs made during the season, indicating therein such material, if any, as may be available for exchange.

11. Institutions and persons receiving permits for excavation shall, after the completion of the work, restore the lands upon which they have worked to their customary condition, to the satisfaction of the field officer in charge.

12. All permits shall be terminable at the discretion of the Secretary having jurisdiction.

13. The field officer in charge of land owned or controlled by the Government of the United States shall, from time to time, inquire and report as to the existence, on or near such lands, of ruins and archeological sites, historic or prehistoric ruins or monuments, objects of antiquity, historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest.

14. The field officer in charge may at all times examine the permit of any person or institution claiming privileges granted in accordance with the act and these rules and regulations, and may fully examine all work done under such permit.

15. All persons duly authorized by the Secretaries of Agriculture, War, and Interior may apprehend or cause to be arrested, as provided in the act of February 6, 1905 (33 Stat. L., 700), any person or persons who appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity on lands under the supervision of the Secretaries of Agriculture, War, and Interior, respectively.

16. Any object of antiquity taken, or collection made, on lands owned or controlled by the United States, without a permit, as prescribed by the act and these rules and regulations, or there taken or made, contrary to the terms of the permit, or contrary to the act and these rules and regulations, may be seized wherever found and at any time, by the proper field officer or by any person duly authorized by the Secretary having jurisdiction, and disposed of as the Secretary shall determine, by deposit in the proper national depository or otherwise.

17. Every collection made under the authority of the act and of these rules and regulations shall be preserved in the public museum designated in the permit and shall be accessible to the public. No such collection shall be removed from such public museum without the written authority of the Secretary of the Smithsonian Institution, and then only to another public museum, where it shall be accessible to the public; and when any public museum, which is a depository of any collection made under the provisions of the act and these rules and regulations, shall cease to exist, every such collection in such public museum shall thereupon revert to the national collections and be placed in the proper national depository.

WASHINGTON, D. C., *December 28, 1906.*

The foregoing rules and regulations are hereby approved in triplicate and, under authority conferred by law on the Secretaries of the Interior, Agriculture, and War, are hereby made and established, to take effect immediately.

E. A. Hitchcock

Secretary of the Interior.

James Wilson

Secretary of Agriculture.

Wm. H. Taft.

Secretary of War.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

BILLINGS DIVISION

UNITED STATES OF AMERICA,	)	
Plaintiff	)	Criminal No. 74-63-BL6
vs.	)	
FARISH JENKINS,	)	16 U.S.C. §433
	)	$500.00 and/or 90 days
Defendant.	)	

INFORMATION

THE UNITED STATES ATTORNEY CHARGES:

That on or about the 20th day of June, 1974, in the N.E.1/4 of Section 17, township 7 South, Range 24 East, of the M.P.M., in the State and District of Montana, FARISH JENKINS did appropriate, excavate, injure, or destroy a historic or prehistoric ruin or monument, or an object of antiquity, situated on lands owned or controlled by the government of the United States, without the permission of the Secretary of the Department of the Government, the Bureau of Land Management, having jurisdiction over the lands on which said antiquities are situated, in violation of Title 16 U.S.C., Section 433.

DATED this 26th day of September, 1974.

OTIS L. PACKWOOD
United States Attorney

_____

ROBERT L. ZIMMERMAN
Assistant U. S. Attorney

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

BILLINGS DIVISION

UNITED STATES OF AMERICA,	)	
Plaintiff	)	CR-74-63-BLG
-vs-	)	
	)	
FARISH JENKINS,	)	DEFENDANT'S REPLY
	)	BRIEF
Defendant.	)	

The Assistant United States Attorney has filed an answer brief attempting to distinguish United States v. Diaz, 499 F. 2d 113. He claims the case is distinguishable because it involved "Indian face masks which were only five years old." Aapparently, the Assistant United States Attorney does not understand what was involved in the Diaz case, supra.

What the Court decided was that the statute, Title 16, U.S.C. Sec 433, was void and unconstitutional. The issue was the validity of the statute which the defendant in this case is charged with violating. It did not involve the question of whether Diaz did or did not violate the statute, as the Assistant United States Attorney assumes.

The statute is either constitutional or it is unconstitutional. It cannot be constitutional in some cases and unconstitutional in others. For that reason, the Diaz case, supra, controls here; and the information should be dismissed.

Respectfully submitted,

ANDERSON, SYMMES, FORBES,

PEETE & BROWN

BY WEYMOUTH D. SYMMES

100 Transwestern Building
Billings, MT 59101

ATTORNEYS FOR DEFENDANT

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

BILLINGS DIVISION

UNITED STATES OF AMERICA,	)	
Plaintiff	)	CR-74-63-BLG
v.	)	
	)	
FARISH JENKINS,	)	BRIEF IN OPPOSITION TO
	)	MOTION TO DISMISS
Defendant.	)	

The defendant, in support of his motion to dismiss has cited the very recent case of United States v. Diaz, 499 F.2d 113, (9th Cir.,1974). The Court there found that the statute, which the defendant is charged in this case of violating is unconstitutionally vague in that it does not define "antiquity".

The facts of the case and this one are clearly distinguishable. In the Diaz case, supra, the "objects of antiquity" were Indian face masks which were only five years old; here we are talking about paleontological objects thousands of years old.

Since the cases are clearly distinguishable, the defendant's motion to dismiss should be overruled.

RESPECTFULLY SUBMITTED this 26th day of December, 1974.

OTIS L. PACKWOOD
United States Attorney for the
District of Montana

_____
ROBERT L. ZIMMERMAN
Assistant United States Attorney

ATTORNEYS FOR PLAINTIFF
UNITED STATES OF AMERICA

ADDRESS: P.O. Box 1478
Billings, MT 51903

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

BILLINGS DIVISION

UNITED STATES OF AMERICA,	)	
Plaintiff	)	CR-74-63-BLG
-vs-	)	
	)	
FARISH JENKINS,	)	BRIEF IN OPPOSITION TO
	)	MOTION TO DISMISS
Defendant.	)	

The defendant, a professor of paleontology from Harvard University, is charged with violating Title 16, United States Code, Section 433, which is as follows:

> "Any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situate on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall, upon conviction, be fined in a sum of not more than $500 or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court."

The specific acts of the defendant upon which the charge is based seem to be the excavation of dinosaur bones. It would seem self-evident that dinosaur bones are not "a prehistoric ruin or monument, or object

of antiquity..." within the meaning of this statute if, in fact, it has a meaning. The United States Court of Appeals for the Ninth Circuit declared the statute void on June 24, 1974, in U.S. v. Diaz, 499 F.2d 113 (Advance Sheets, September 16, 1974). In declaring this statute unconstitutional, the Court held (p. 114):

> "Nowhere do we find any definition of such terms as 'ruin' or 'monument' (whether historic or prehistoric) or 'object of antiquity.' The statute does not limit itself to Indian reservations or to Indian relics. Hobbyists who explore the desert and its ghost towns for arrowheads and antique bottles could arguably find themselves within the Act's proscriptions. Counsel on neither side was able to cite an instance prior to this in which conviction under the statute was sought by the United States."

In the light of this decision, we think this Court has no alternative but to dismiss the information. The defendant is not charged with a public offense within the meaning of the due process clause of the United States Constitution.

Respectfully submitted,

ANDERSON, SYMMES, FORBES, PEETE & BROWN

BY Weymouth D. Symmes
100 Transwestern Building
404 North 31st St.
Billings, MT 59101

ATTORNEYS FOR DEFENDANT

CERTIFICATE OF SERVICE

This is to certify that the foregoing was duly served by recil upon all attorneys of record at their address or addresses this 26 day of December , 1974

By _____
404 N. 31st St. - Billings, Mont 59101

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

UNITED STATES OF AMERICA,
Plaintiff-Appellee,
vs. No. 74-1177

BEN DIAZ, Defendant-Appellant.

[June 24, 1973]

On Appeal from the United States District Court
for the District of Arizona

Before: MERRILL and KOELSCH, Circuit Judges,
and SWEIGERT,* District Judge
MERRILL, Circuit Judge

Appellant was charged in 1973 with appropriating "objects of antiquity situated on lands owned and controlled by the Government of the United States without the permission of the Secretary of Interior," contrary to 16 U.S.C. §433.[1]

The items appropriated were face masks found in a cave on the San Carlos Indian Reservation. They were identified by a San Carlos medicine man as having been made in 1969 or 1970 by another medicine man personally known to him. A professor of anthropology at the University of Arizona testified as an expert on the religious systems of the Western Apache in the State of Arizona. He testified that artifacts such as those appropriated by appellant were used by the Apache Indians in religious ceremonies and that after the conclusion of ceremonies the artifacts traditionally were deposited in remote places on the reservation for religious reasons; that the artifacts are never allowed off the reservation and that they are considered sacred and may not be handled by anyone except the medicine man once they are stored in a cave. He further testified that in anthropological terms "object of antiquity" could include something that was made just yesterday if

---

*"Honorable William T. Sweigert, Senior United States District Judge for the Northern District of California, sitting by designation.

[1]That section provides:

"Any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction be fined in a sum of not more than $500 or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court."

related to religious or social traditions of long standing. In his opinion the artifacts in the instant case were antiquities despite the fact that they were no more than three or four years old.

We have no doubt as to the wisdom of the legislative judgment (made close to seventy years ago and reinforced by experiences of the present in the despoliation of public lands) that public interest in and respect for the culture and heritage of native Americans requires protection of their sacred places, past and present, against commercial plundering.

Protection, however, can involve resort to terms that, absent legislative definition, can have different meanings to different people. One must be able to know, with reasonable certainty, when he has happened on an area forbidden to his pick and shovel and what objects he must leave as he has found them.

Nowhere here do we find any definition of such terms as "ruin" or "monument" (whether historic or prehistoric) or "object of antiquity." The statue does not limit itself to Indian reservations or to Indian relics. Hobbyists who explore the desert and its ghost towns for arrowheads and antique bottles could arguably find themselves within the Act's proscriptions. Counsel on neither side was able to cite an instance prior to this in which conviction under the statute was sought by the United States.

In Connally v. General Const. Co., 269 U.S. 385, 391 (1926), the Court, in discussing the due process requirement of legislative specificity, stated:

> "That the terms of a penal statute creating a new offense must be sufficiently explicit to inform those who are subject to it what conduct on their part will render them liable to its penalties, is a well-recognized requirement, consonant alike with ordinary notions of fair play and the settled rules of law. And a statute which either forbids or requires the doing of an act in terms so vague that men of common intelligence must necessarily guess as its meaning and differ as to its application, violates the first essential of due process of law."

In Grayned v. City of Rockford, 408 U.S. 104, 108-09 (1972), it was stated:

> "Vague laws offend several important values. First, because we assume that man is free to steer between lawful and unlawful conduct, we insist that laws give the person of ordinary intelligence a reasonable opportunity to know what is prohibited, so that he may act accordingly. Vague laws may trap the innocent by not providing fair warning. [Footnote omitted] Second, if arbitrary and discriminatory enforcement is to be prevented, laws must provide explicit standards for those who apply them. A vague law impermissibly delegates

basic policy matters to policemen, judges, and juries for resolution on an *ad hoc* and subjective basis, with the attendant dangers of arbitrary and discriminatory application."

Here there was no notice whatsoever given by the statute that the word "antiquity" can have reference not only to the age of an object but also to the use for which the object was made and to which it was put, subjects not likely to be of common knowledge.

In our judgment the statute, by use of undefined terms of uncommon usage, is fatally vague in violation of the due process clause of the Constitution.

Judgment reversed.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

BILLINGS DIVISION

UNITED STATES OF AMERICA,	)	
Plaintiff,	)	CR-74-63-BLG
-vs-	)	
FARISH JENKINS,	)	ORDER
Defendant.	)	

The defendant is charged herein with a violation of 16 U.S.C. § 433. The Ninth Circuit Court of Appeals has held that the above statute is unconstitutional. United States v. Diaz, 499 F.2d 113 (1974).

On motion of the defendant, IT IS THEREFORE ORDERED that the information on file herein be dismissed.

Done and dated this 13th day of January, 1975

James F. Batten

United States District Judge

APPENDIX P

REGULATION OF FOSSIL COLLECTING IN SOME OTHER COUNTRIES

Britain is a small and densely populated country with a disproportionately large number of historically important geological localities. Apart from many coastal exposures, the great majority of sites of special geological interest are on land that is privately owned. The strong emphasis on geologic conservation which has developed among professional geologists in that country reflects, in part, these differences from the situation in the United States. Paleontological localities in particular are seen to be vulnerable to commercial or residential development, filling in where quarries become dumps or the land is reclaimed, degradation where erosion is prevented by coastal protection, unscrupulous and unscientific commercial collecting, and overuse by amateur and professional geologists. These considerations have led to a rather general perception that the regulation of development is necessary and that fossil collecting must be restricted at those relatively few sites where scientifically important fossils occur in a horizon of limited extent. Recently, however, a lively debate has erupted between those who hold this view and those who feel that both the public interest and the science of paleontology would be best served by freedom of access to all fossiliferous localities.

The main responsibility for geological conservation in Britain is vested in a government agency, the Nature Conservancy Council, which was established by Royal Charter in 1949. In a major statement of its mission, the Nature Conservancy Council (1984) asserted:

> The primary objective of nature conservation is to ensure that the national heritage of wild fauna and flora and geological and physiographic features remains as large and diverse as possible, so that society may use and appreciate its value to the fullest extent.

This document focuses almost exclusively on fauna and flora, which has caused considerable concern among British geologists (Conservation Committee, Geological Society of London, 1985).

The Nature Conservancy Council is engaged in a detailed Geological Conservation Review, initiated in 1977. Important sites may be protected in one of two ways. 1) National Nature Reserves may be purchased by the Nature Conservancy Council, or much more often an agreement is reached with the owner whereby the Nature Conservancy Council becomes responsible for the management of the site. Only a handful of these reserves are primarily of geological significance, but the Achanarras Quarry, famous for its Devonian fishes, is one of them. (2) Localities designated as Sites of Special Scientific Interest are protected under Section 23 of the National Parks and Access to the Countryside Act, 1949. Local planning authorities are required under this act to consult with the Nature Conservancy Council before any application bearing on such a site is approved. There were 984 geological sites in this category by 1984 and it is anticipated that there will be about 1,500, including 190 fossil vertebrate localities, upon completion of the Geological Conservation Review.

An even more extensive compilation is being undertaken voluntarily by the Geological Site Documentation Committee of the Geological Curators Group, a division of the Museums Association. So far, 19,000 sites have been recorded, but no special protection is accorded to these localities.

The Nature Conservancy Council contributes directly to the development of British geological and paleontological sites and to their study in additional ways. Important stratigraphic sections that have become obscured by slumping and vegetation are excavated and reopened. Alternate collecting localities are sought out and publicized, to take pressure off classic localities that are being overused by geological field parties. A modest number of guidebooks to sites and other educational booklets have been published.

In Canada, regulation of fossil collecting is the responsibility of the Provinces, except in the case of the Canadian Territories and National Parks, which are under Federal control. In Alberta, "the property in all archaeological resources and paleontological resources within Alberta is vested in the Crown in Right of Alberta" (Historical Resources Act, 1973, Revised Statutes of Alberta 1980, Chapter H-8, section 2B-1). A paleontological resource is "a work of nature consisting of or containing evidence of extinct multicellular beings." (Ibid, section 1-i). Research permits are required for the excavation of historic resources "on any land in Alberta" (Ibid, section 26-1), but the regulations do not appear to govern surface collecting, unless the material is sold or damaged (forbidden) or transported out of Alberta (requires a permit). Applications for permits are examined by the Alberta Palaeontological Advisory Committee, which recommends appropriate action to the Minister of Culture. In the Alberta provincial parks, Recreation Areas, Wilderness Areas and Ecological Reserves, the collection or removal of geological specimens or historic resources as defined in the Historical Resources Act is classified as "Restricted Research", which automatically requires a permit. Such

research is allowed where it promises to show significant benefits and its impact on the environment and its recreational use are negligible.

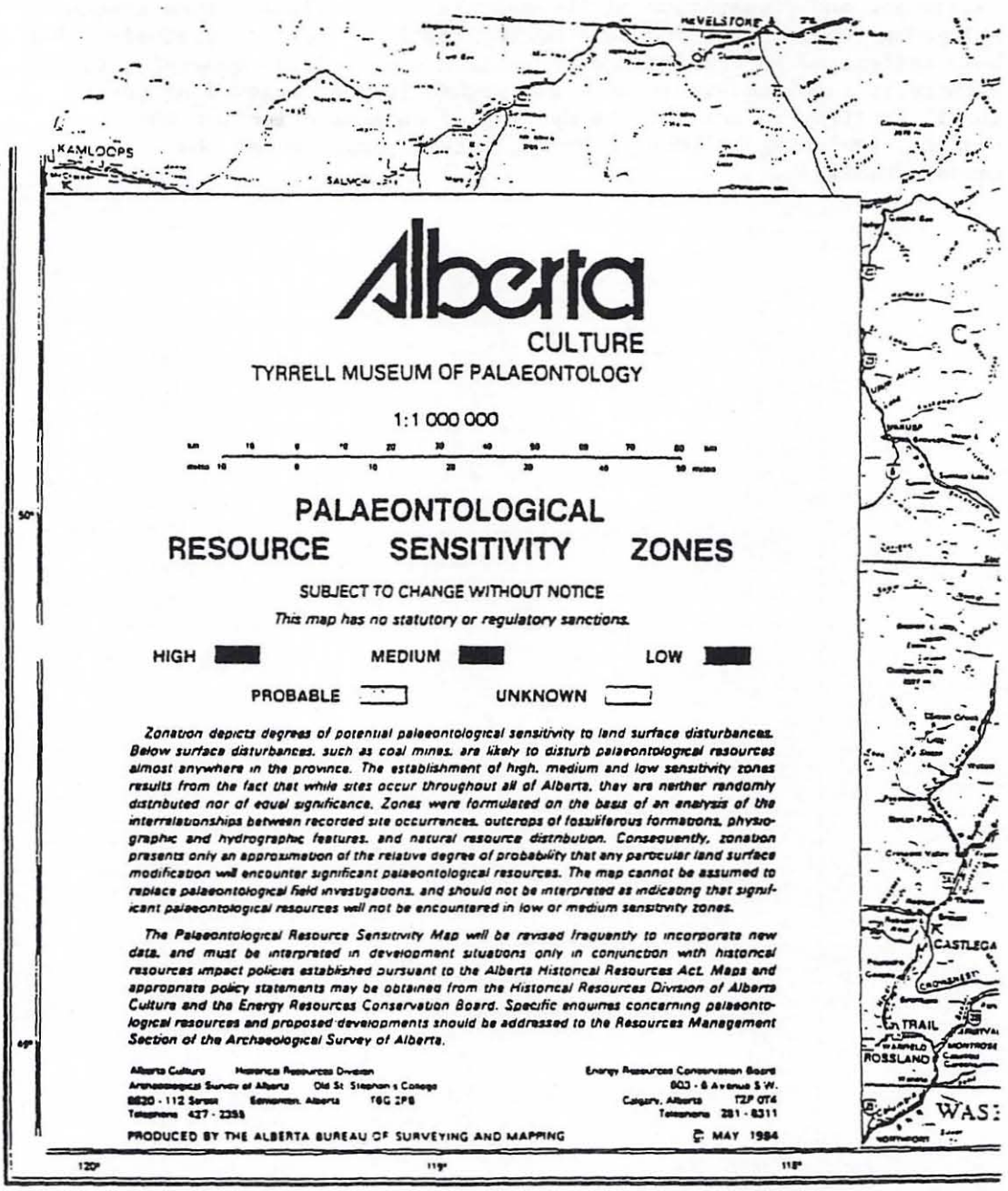
A partial inventory of actual and potential paleontological resources has been compiled for the Alberta Department of Culture by its agency, the Tyrrell Museum of Palaeontology. This has led to the publication in 1984 of a map showing the distribution of "Paleontological Resource Sensitivity Zones" in Alberta. The legend to this map (attached) indicates the basis on which its zones were established and includes several caveats about its provisional nature and legal status. The famous dinosaur-bearing strata of the Red Deer River valley are protected in Dinosaur Provincial Park, which was registered in 1979 as a World Heritage Site under the 1972 International Convention Concerning the Protection of the World Cultural and Natural Heritage.

The export of fossils beyond Canada is controlled by the Cultural Property Export and Import Act of 1975. Export of items covered by this law requires a permit, which may be denied if the objects are deemed to be of outstanding significance and national importance, and if a fair cash offer to purchase the objects is forthcoming from a Canadian institution or public authority. Categories of fossils governed by the law are defined in the Canadian Cultural property Export Control list (1977, p. 3):

> Palaeontological specimens of interest for scientific, educational or display purposes as follows:
> (a) a type specimen of any value,
> (b) fossil amber of any value,
> (c) a vertebrate fossil specimen of a fair market value in Canada of more than fifty dollars,
> (d) an invertebrate fossil specimen of a fair market value in Canada of more than two hundred and fifty dollars,
> (e) fossil specimens in bulk weighing 25 pounds (11.25 kgs) or more of vertebrate fossils or vertebrate trace fossils of any value,
> (f) fossil specimens in bulk weighing 50 pounds (22.5 kgs) or more, recovered from a specific outcrop, quarry or locality, that include one or more specimens of any value of the following:
> (i) invertebrate fossils
> (ii) plant fossils, or
> (iii) fossiliferous rock containing fossils of plants or invertebrates, recovered from the soil of Canada or the inland or other internal waters of Canada."

This list clearly illustrates the difficulties that are encountered in any attempt to establish criteria of significance for fossils in general terms.

In West Germany, the regulation of fossil collecting is likewise a state rather than federal responsibility. In Baden-Wurttemberg, rare fossils are the property of the Land (state), protected under the "Gesetz zum Schutz der Kulturdenkmale" or Law for the Protection of Cultural Monuments. In Wurttemberg, the discovery of protected fossils must by law be reported to the Staatliches Museum fur Naturkunde, in Stuttgart. If the Land takes possession of a specimen, the finder receives a reward from the state and compensation for time spent in excavation and preparation of the material. The classic area around Holzmaden, where Lower Jurassic marine reptiles occur in profusion, has been designated as a protected excavation area. Here, quarrying by machine is regulated to enhance the probability of recovering the fossil reptiles intact and the opening of an excavation for any purpose, including building a house, must be approved by the Landesdenkmalamt.


KAMLOOPS
SALMON
REVELSTOKE
Alberta
CULTURE
TYRRELL MUSEUM OF PALAEONTOLOGY
1:1 000 000
PALAEONTOLOGICAL
RESOURCE SENSITIVITY ZONES
SUBJECT TO CHANGE WITHOUT NOTICE
This map has no statutory or regulatory sanctions.
HIGH
MEDIUM
LOW
PROBABLE
UNKNOWN
Zonation depicts degrees of potential palaeontological sensitivity to land surface disturbances. Below surface disturbances, such as coal mines, are likely to disturb palaeontological resources almost anywhere in the province. The establishment of high, medium and low sensitivity zones results from the fact that while sites occur throughout all of Alberta, they are neither randomly distributed nor of equal significance. Zones were formulated on the basis of an analysis of the interrelationships between recorded site occurrences, outcrops of fossiliferous formations, physiographic and hydrographic features, and natural resource distribution. Consequently, zonation presents only an approximation of the relative degree of probability that any particular land surface modification will encounter significant palaeontological resources. The map cannot be assumed to replace palaeontological field investigations, and should not be interpreted as indicating that significant palaeontological resources will not be encountered in low or medium sensitivity zones.
The Palaeontological Resource Sensitivity Map will be revised frequently to incorporate new data, and must be interpreted in development situations only in conjunction with historical resources impact policies established pursuant to the Alberta Historical Resources Act. Maps and appropriate policy statements may be obtained from the Historical Resources Division of Alberta Culture and the Energy Resources Conservation Board. Specific enquiries concerning palaeontological resources and proposed developments should be addressed to the Resources Management Section of the Archaeological Survey of Alberta.
Alberta Culture Historical Resources Division
Archaeological Survey of Alberta Old St. Stephen's College
8820 - 112 Street Edmonton, Alberta T6G 2P8
Telephone 427 - 2288
Energy Resources Conservation Board
603 - 6 Avenue S.W.
Calgary, Alberta T2P 0T4
Telephone 281 - 6311
PRODUCED BY THE ALBERTA BUREAU OF SURVEYING AND MAPPING
© MAY 1984
CASTLEGA
TRAIL
ROSSLAND
120°
119°
118°

APPENDIX Q

NATIONAL NATURAL LANDMARKS PROGRAM

The National Park Service maintains an active program of designating sites or areas of special natural significance known as NATIONAL NATURAL LANDMARKS. Approximately 550 such designations have been made to date, about half of which are on public lands and half are privately held or have a mixture of public and private ownership. A Park Service summary statement of the Program is:

NATIONAL PARK SERVICE
Interagency Resources Division
Natural Areas Survey Branch
NATIONAL NATURAL LANDMARKS PROGRAM

PROGRAM PURPOSE

The National Natural Landmarks Program was established in 1962 by the Secretary of the Interior to encourage preservation of the best remaining examples of the major biotic communities and geologic features in the continental United States, Puerto Rico, the Virgin Islands, Hawaii, Guam, the Commonwealth of the Northern Marianas, American Samoa, and the Trust Territory of the Pacific Islands. It is the only natural areas program of national scope to identify and recognize best examples of both biological and geological features without regard to site ownership or management.

In broader terms, the Program seeks to encourage the preservation of natural diversity, which comprises species, biotic communities, and their associated habitats, and may also be defined to include landforms, geologic structures, fossil deposits, and other types of features that compose the natural landscape. The preservation of natural diversity has important scientific, economic, educational, recreational, and aesthetic value, and is accomplished primarily through the conservation of natural areas that retain samples of natural diversity. Natural areas are linked further to the functioning of the biosphere, upon which man's survival ultimately is dependent.

PROGRAM APPROACH

Because the character of natural diversity is regionally distinct

APPENDIX R

LEGAL HISTORY AND INTERPRETATIONS

LAWS AND REGULATIONS PERTAINING TO FOSSILS

I. INTRODUCTION

There is no federal legislation designed specifically for protection of fossils on federal public lands,[1] as there is for archaeological resources. Nevertheless, ample statutory authority exists for the various federal land management agencies to protect, manage and dispose of fossils on public lands. However, with few exceptions, existing statutes do not impose a duty on federal agencies to manage or preserve fossils on public lands. Among the exceptions to this general statement are specific federal statutes establishing national monuments for purposes of preserving fossil remains.[2] Thus the issue of whether federal agencies should regulate scientific or amateur fossil collecting by means of a permit system is largely a policy question, rather than a legal question. Fossil collecting for commercial purposes, however, probably requires some kind of permit system under existing law to ensure payment of adequate compensation.[3]

With few exceptions, neither archaeological nor paleontological resources located on private lands are regulated or protected by federal or state legislation. The exceptions include voluntary designation of private sites as national or state landmarks, certain prohibitions against federal actions or undertakings (e.g., federal construction projects or federally funded or licensed projects) that might destroy certain materials, and unsuitability designation for surface mining. Ownership of paleontological and archaeological resources located on private lands rests with the private landowner.

Sections II and III of this appendix summarize both general and agency-specific statutes that may apply to fossils on federal public lands. Brief summaries of laws designed primarily to protect archaeological or historic resources are included both for comparative purposes and because there may be some uncertainty about their applicability to fossils. Section IV summarizes state laws that pertain to fossils. Section V discusses ownership of fossils on "split estate" lands where the surface estate and mineral estate are in separate ownership.

II. FEDERAL STATUTES - GENERAL

A. Antiquities Act

The Antiquities Act of 1906[4] requires a permit for excavation or removal of "any historic or prehistoric ruin or monument, or any object of antiquity" located on federal public lands.[5] Unauthorized appropriation, excavation, injury, or destruction of such objects is punishable by a fine of up to $500 or ninety days imprisonment, or both.[6] Permits "for the examination of ruins, the excavation of ruins, the excavation of archaeological sites, and the gathering of objects of antiquity" may be issued by the secretary of the department with jurisdiction over the land. Permits may be issued only to "qualified" institutions for the benefit of "reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such objects."[7] Specimens collected must be permanently preserved in public museums.[8] Regulations implementing the permit provisions of the Antiquities Act include reporting, curation, and land restoration requirements.[9]

A separate section of the Antiquities Act authorizes the President to establish national monuments to preserve regional "historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest" located on federal public lands.[10] Dinosaur National Monument, for example, was established by presidential proclamation pursuant to this section of the Antiquities Act.[11]

Although the Antiquities Act does not mention fossils or paleontology, fossils clearly fall within "objects of scientific interest" under the section of the Act authorizing national monuments. It is less clear that fossils were intended to be covered by the permitting provisions of the Act, as "objects of antiquity."

While no reported cases have considered the application of the Act's permit provisions to fossils, the legislative history of the Antiquities Act indicates that Congress was primarily concerned with cultural and archaeological resources.[12] Early administrative interpretation of the Act, however, included fossils within the meaning of the phrase "objects of antiquity," thereby subjecting them to the permitting provisions of the Act, whether or not they were found in an archaeological context.[13] In practice, only vertebrate fossils and certain types of invertebrate fossils, determined on a case-by-case basis to be of significant scientific interest, were subject to the Antiquities Act permit procedures. In 1977, the Solicitor's Office of the Department of the Interior reconsidered this interpretation, advising that "it would be...more appropriate to adopt a legal strategy which excludes paleontological objects from the Antiquities Act and provides protection for these specimens under the other authorities available to the Department."[14] Despite this advice, some Interior agencies have continued to rely on the Antiquities Act to require permits for vertebrate fossils.

The Solicitor's advice was based in part on the strict construction of the Antiquities Act by the Ninth Circuit Court of Appeals in United States v. Ben Diaz,[15] In Diaz, the court considered the conviction of an individual charged under the Antiquities Act with unauthorized taking from reservation lands of Indian face masks which had been made in 1969 or 1970. The government asserted that "object of antiquity" could include "something that was made just yesterday if related to religious or social traditions of long standing."[16] The court, however, found the terms "ruin," "monument," and "object of antiquity," to be undefined and vague, stating:

> One must be able to know, with reasonable certainty, when he has happened on an area forbidden to his pick and shovel and what objects he must leave as he has found them.[17]

The court applied the "void for vagueness" doctrine and held that "the statute, by use of undefined terms of uncommon usage, is fatally vague in violation of the due process clause of the Constitution."[18] The only known prosecution for fossil collecting under the Antiquities Act was dismissed on the basis to the Ninth Circuit's decision in Diaz.[19]

In a subsequent case, the Tenth Circuit Court of Appeals disagreed with the Ninth Circuit and upheld the constitutionality of the Antiquities Act against a similar claim of statutory vagueness (though on clearly distinguishable facts). In United States v. Smyer,[20] the defendant was convicted of taking 800-900 year old Mimbres artifacts for commercial purposes from National Forest lands in New Mexico. The court held that "the Antiquities Act gives a person of ordinary intelligence a reasonable opportunity to know that excavating prehistoric Indian burial grounds and appropriating 800-900 year old artifacts is prohibited."[21]

Even in Ninth Circuit jurisdictions, the Diaz decision has not foreclosed criminal prosecution under the more general theft and malicious mischief statutes[22] for conduct that is also covered by the Antiquities Act. In United States v. Jones,[23] the court upheld convictions under these statutes for theft of Indian artifacts from federal lands, applying the rule that "where an act violates more than one statute, the Government may elect to prosecute under either unless the congressional history indicates that Congress intended to disallow the use of the more general statute."[24]

As recently as 1984, the Interior Department apparently considered fossils to be subject to the Antiquities Act. Secretarial Order No. 3104 redelegated "authority for issuance of archaeological and paleontological permits" under the Antiquities Act and the Archaeological Resources Protection Act from the National Park Service to the various assistant secretaries, for redelegation to the land management agencies.[25] Much of the current confusion over paleontological permitting concerns the authority of these agencies under the Antiquities Act or other statutes.

B. Archaeological Resources Protection Act of 1979

The Archaeological Resources Protection Act of 1979 (ARPA),[26] protects archaeological resources and sites which are located on federal public lands and Indian lands. ARPA establishes a permit system for excavation or removal of these resources and provides for both civil and criminal penalties. Removal of arrowheads located on the surface of the ground are exempt from both criminal and civil penalties. The Act is directed primarily at commercial exploitation of archaeological resources on public lands.

Most paleontological resources are expressly excluded from coverage by ARPA. The Act's definition of "archaeological resource" excludes nonfossilized and fossilized paleontological specimens, unless found in an archaeological context.[27]

C. Historic Preservation Statutes

The Historic Sites Act of 1935 provides for preservation of "historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States."[28] It authorizes the Secretary of the Interior to survey, investigate, acquire and preserve historical and archaeological sites of national significance.[29] The National Historic Preservation Act of 1966 (NHPA)[30] greatly expanded protection of historic and archaeological sites and established the National Register of Historic Places. The term "historic preservation" under NHPA includes "protection ... of districts, sites, buildings, structures and objects significant in American history, architecture, archaeology, or culture."

The National Natural Landmarks (NNL) program[31] is administered by the National Park Service pursuant to the Historic Sites Act.[32] The stated purpose of the NNL program is to "identify and encourage the preservation of nationally significant examples of the full range of ecological and geological features that constitute the nation's natural heritage.[33] The regulations define "National Natural Landmark" as "an area of national significance...that contains an outstanding representative example(s) of the nation's natural heritage, including ...geological features,...or fossil evidence of the development of life on earth." "National significance" is defined as "a recognition given to those examples of the full range of ecological and geological features, the usual as well as the unique, which best represent the nation's heritage, the knowledge and appreciation of which are important for the perpetuation of their inherent natural values and for associated scientific, educational, recreational or inspirational benefit."[34] Identification, designation, and monitoring of NNLs are done by the National Park Service. Private landowners are encouraged to enter into voluntary cooperative agreements to protect significant values of the landmark.[35] NNLs designated on public lands remain under the jurisdiction of the land managing agency.

The Reservoir Salvage Act of 1960 requires preservation of "historical and archaeological data" and specimens that might be destroyed as a result of dam construction projects by federal agencies

or private entities holding a federal license.[36] This act represents an alternative to the site preservation approach of the Historic Sites Act; namely, study, salvage, and preservation of site records while allowing development to proceed. The Archaeological and Historic Preservation Act of 1974 amended the Reservoir Salvage Act and extended its coverage from dams to all federal, federally funded, or federally licensed construction projects.[37] The present law includes detailed procedures for investigation and salvage of "scientific, prehistorical, historical, or archaeological data" threatened with destruction. It also provides for funding of such investigations, and compensation for loss due to delays in construction or temporary loss of the use of nonfederal land.[38] Although this legislation makes no reference to fossils or paleontological data, they could conceivably fall within the "scientific data" category. The stated purpose of the statute is to further the policy set forth in the Historic Sites Act, which appears to be directed primarily at historic and archaeologic preservation.

D. National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA)[39] imposes primarily procedural, rather than substantive, requirements on the decisionmaking process of federal agencies. NEPA requires federal agencies to prepare an environmental impact statement (EIS) on any proposal for a "major federal action significantly affecting the quality of the human environment."[40] Federal regulations interpret "human environment" broadly to include the "natural and physical environment."[41] In determining whether the environment is "significantly" affected, federal agencies are directed to consider the degree to which the action may "cause loss or destruction of significant scientific, cultural, or historical resources."[42]

An EIS must include a detailed statement on the following:

(i) The environmental impact of the proposed action,
(ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,
(iii) Alternatives to the proposed action,
(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.[43]

Preparation of an EIS can be a lengthy process, in part because of the extensive requirements for public participation. Agencies generally prepare an environmental assessment (EA) on proposed actions to determine whether an EIS is necessary, i.e., to determine whether the action is "major" or will have a "significant effect on the quality of the human environment." Once an agency has complied with NEPA's procedural requirements,[44] however, the Act does not require that the agency's decision be the environmentally "correct" one, or even the

one with the least environmental impact (which is usually the "no action" alternative). As construed by the Supreme Court, NEPA does not require agencies to elevate environmental considerations over other appropriate considerations in selecting a course of action.[45] NEPA merely requires that the agency give adequate consideration to environmental consequences in its decisionmaking process.[46]

In the process of complying with NEPA, an agency may be required to evaluate the impact of a proposed action on scientifically significant fossils, if any, and to develop alternatives or mitigation measures. However, NEPA does not mandate any particular approach to inventory or management of fossils.[47]

E. 1872 Mining Law

The 1872 Mining Law provides for the location and patent of certain valuable mineral deposits that are not otherwise subject to disposal under the 1920 Mineral Leasing Act[48] or the 1947 Materials Act.[49] Minerals subject to location of mining claims under the 1872 Mining Law are generally "hardrock" minerals such as gold, silver, lead, zinc, etc. Neither petrified wood nor the fossil remains of animals may be claimed under the 1872 Mining Law.

In 1913, one Earl Douglas attempted to appropriate the fossil remains of dinosaurs and other prehistoric animals near Vernal, Utah, by location of placer mining claims for the Carnegie Museum. In an administrative appeal, the Interior Department upheld cancellation of the claim, holding that such remains "are not mineral within the meaning of the United States mining laws, and lands containing such remains are not subject to entry under such laws."[50]

A 1962 amendment to the mining laws defined petrified wood and provided that no deposit of petrified wood shall be deemed a valuable mineral deposit within the meaning of the 1872 Mining Law.[51] The amendment also directed the Secretary of the Interior to "provide by regulation that limited quantities of petrified wood may be removed without charge from those public lands which he shall specify."[52]

Both the Bureau of Land Management[53] and the Forest Service[54] regulate the surface effects of exploration and development activities under the 1872 Mining Law.[55] BLM regulations require all operations, including casual use, to prevent unnecessary or undue degradation of the public lands and to protect environmental values, including cultural resources and paleontological materials. BLM regulations are quite specific on mining operators' duties to protect fossils:

(1) Operators shall not knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains or any historical or archaeological site, structure, building or object on Federal lands.
(2) Operators shall immediately bring to the attention of the authorized officer any cultural and/or paleontological resources that might be altered or destroyed on Federal lands by his/her operations, and shall leave such discovery

intact until told to proceed by the authorized officer. The authorized officer shall evaluate the discoveries brought to his/her attention, take action to protect or remove the resource, and allow operations to proceed within 10 working days after notification to the authorized officer of such discovery.

(3) The Federal Government shall have the responsibility and bear the cost of investigations and salvage of cultural and paleontology values discovered after a plan of operations has been approved, or where a plan is not involved.[56]

It is not clear how the operator is to determine whether a particular fossil is "scientifically important."

The comparable Forest Service regulations require that all operations be conducted, where feasible, so as to minimize adverse effects on surface resources, without mentioning fossils.[57]

F. Petrified Wood

As noted above, Congress in 1962 directed the Secretary of the Interior "to provide by regulation that limited quantities of petrified wood may be removed without charge from those public lands which he shall specify."[58] Interior regulations allow collection of limited quantities of petrified wood for noncommercial purposes without a permit, except for specimens over 250 pounds in weight.[59] The maximum quantity of petrified wood that any one person may remove without charge per day is 25 pounds plus one piece, provided that the total amount removed per person per year may not exceed 250 pounds.[60] Except as authorized by a permit to remove museum pieces, the use of explosives or power equipment is not permitted in the removal of petrified wood under the free use provisions.[61] Collection is to be done in a manner that prevents unnecessary and undue degradation of lands.[62] The head of an agency having jurisdiction over a free use area may adopt supplemental rules for collection.[63]

Specimens removed under the free use provisions may not be sold or bartered to commercial dealers.[64] Collection of petrified wood for commercial purposes is governed by the 1947 Materials Act and the regulations pertaining to mineral material sales.[65]

G. Materials Act of 1947

The Materials Act of 1947[66] authorizes the Secretaries of Interior and Agriculture to dispose of mineral and vegetative materials that are not expressly covered by other laws. The Act does not apply to national parks, national monuments, or Indian lands.[67] Mineral materials are defined to include, without limitation, common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. The Act requires payment of "adequate compensation" for such materials and generally requires competitive bidding, although negotiated contracts are permitted in certain circumstances. Federal or state agencies or subdivisions, and nonprofit organizations, may be granted free use

permits for noncommercial purposes.[68] The Materials Act appears to be the only statutory authority for disposal of fossils from public lands for commercial purposes.

H. Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act of 1977 (SMCRA)[69] regulates the environmental effects of coal mining on both federal and private lands. The federal agency primarily responsible for implementing SMCRA is the Office of Surface Mining (OSM). States with approved programs may assume primary responsibility for administering SMCRA within the state. SMCRA does not mention fossils or paleontological data, although it does refer to archaeological sites. The Act provides that permit applications must contain a map that includes "all manmade features and significant known archaeological sites existing on the date of application."[70] As originally proposed, OSM regulations would have also required identification of paleontological features as part of the mine permit application. This requirement was dropped in the final regulations, apparently on the basis of a legal conclusion that SMCRA and the National Historic Preservation Act require only that manmade cultural, historical, and archaeological features be protected in the mining permit process.[71]

Under OSM's final regulations, the only protection for fossils provided by SMCRA is the designation of lands as unsuitable for surface coal mining. Lands may be so designated if, inter alia, such mining would "affect fragile or historic lands in which such operations could result in significant damage to important cultural, scientific, and esthetic values and natural systems...."[72] Apparently only one petition has been filed (in New Mexico) seeking unsuitability designation based on paleontologic values. The petition was rejected in that case since the company had proposed a plan for surveying the permit area for fossils prior to mining and had committed to stop mining and ask the regulatory authority for a significance determination if a potentially significant fossil were found during mining.

III. FEDERAL LAND MANAGEMENT AGENCIES

A. Department of Agriculture - Forest Service

The Secretary of Agriculture has broad authority under its organic act to regulate the occupancy and use of national forests.[73] Any violation of the statute or regulations promulgated thereunder by the Forest Service is punishable by a fine of not more than $500 or imprisonment of not more than six months, or both.[74]

Until recently, Forest Service regulations prohibited excavation or collection of any paleontological resources without a special use permit.[75] The regulations define paleontological resources as "any evidence of fossilized remains of multicellular plants, including imprints thereof" excluding organic remains primarily collected for use

as fuel such as coal and oil.[76] There has been at least one recent conviction under these regulations for fossil collecting without a permit on Forest Service lands.[77]

In August, 1986, the Forest Service published an interim final rulemaking that limits this permit requirement to collecting of any vertebrate fossil and to commercial collecting of any paleontological resources.[78] Two primary reasons were stated for the rule change. First, the distinction between "archaeological" and "paleontological" resources in the Archaeological Resources Protection Act of 1979 (ARPA) implies that federal land management agencies are not mandated to exercise the same degree of protection for the two resources. Second, the collection of paleontological objects on National Forest lands is "a legitimate scientific and educational pursuit and there is no evidence of widespread conflicts or problems that would require a blanket prohibition" on such activities. Vertebrate fossils, however, "have traditionally been accorded special significance and will remain subject to regulation."[79] Even with this rule change, Forest Service land managers may still issue special closure orders to protect fossils. Such closures are authorized for the protection of, inter alia, "objects or areas of historical, archaeological, geological, or paleontological interest" or for "scientific experiments or investigations."[80] Entry into special closure areas may be authorized by special use permits.[81] Fossils found in an archaeological context are subject to separate regulations and permits pursuant to ARPA.[82]

B. Department of the Interior

1. Bureau of Land Management

The 1976 Federal Land Management and Policy Act (FLPMA)[83] provides broad general authority for the Bureau of Land Management (BLM) to regulate the use and occupancy of public lands under its jurisdiction "through permits, leases, licenses, published rules, or other instruments as the Secretary deems appropriate."[84] FLPMA also directs the Secretary to, by regulation or otherwise, take any action necessary to prevent "unnecessary or undue degradation" of the public lands under BLM jurisdiction.[85] Thus BLM has authority to regulate collection of fossils by means of a permit system, if it chooses to do so. BLM also has a duty to prevent any unnecessary or undue degradation of the public lands that might be caused by fossil collecting. However, FLPMA does not require BLM to regulate all types of fossil collecting by means of permits.

Unlike archaeological resources, fossils are not specifically mentioned in FLPMA. However, FLPMA does contain several references to "scientific values" of the public lands, which would presumably include fossils (at least those that are of scientific value). For example, FLPMA directs BLM to manage the public lands under principles of "multiple use and sustained yield" in accordance with land use plans.[86] The term "multiple use" is defined in part to mean "a combination of balanced and diverse resource uses that takes into

account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values."[87]

Also, among FLPMA's declarations of policy is a statement that the public lands are to be "managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values...and that will provide for outdoor recreation and human occupancy and use."[88] Another policy declaration provides that the United States should "receive fair market value of the use of the public lands and their resources unless otherwise provided for by statute."[89] However, the policy declarations of FLPMA become effective only with specific statutory authority for their implementation as provided by FLPMA or other legislation.[90]

Fossils, as a component or "value" of the public lands, are arguably subject to FLPMA's inventory provisions. FLPMA directs the Secretary to "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including, but not limited to, outdoor recreation and scenic values), giving priority to areas of critical environmental concern."[91] "Areas of critical environmental concern" (ACEC's) are defined as "areas within the public lands where special management attention is required...to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards."[92] Scientifically significant fossil localities would presumably fall within the category of "natural systems or processes." BLM has used ACEC designation extensively to protect fossil localities.[93]

BLM has also used "Research Natural Area" (RNA) designation[94] (under the general authority of FLPMA) to manage and protect fossil localities. RNAs are defined in the regulations as "an area that is established and maintained for the primary purpose of research and education because the land has one or more of the following characteristics:...(4) a typical representation of common geologic, soil, or water features; or (5) outstanding or unusual geologic, soil or water features."[95] It is not clear from the regulations whether a permit is required to use such areas.

The BLM manages the "Fossil Forest" in New Mexico as a research natural area under special regulations promulgated in 1985.[96] This area was withdrawn from the mining and mineral leasing laws by the San Juan Basin Wilderness Protection Act of 1984,[97] which directed the Secretary to manage the area to prevent impairment of its existing natural, educational, and scientific research values, including paleontological study, excavation, and interpretation. Fossils may be collected only with a special use permit issued by the BLM state office.[98] Permits may be issued only to institutions and individuals engaged in research, museum, or educational projects that provide for detailed recordation, reporting, care of specimens, and

availability of specimens to other scientists and museums.[99] BLM also manages a number of National Natural Landmarks designated for paleontological values.[100]

Noncommercial collecting of fossils other than petrified wood or vertebrate fossils on BLM-managed lands is currently covered only by general "conduct" regulations.[101] These regulations allow collecting of "reasonable amounts" of nonrenewable resources such as rocks, mineral specimens, common invertebrate fossils, and semiprecious gemstones, except where otherwise prohibited. BLM proposed consolidated regulations for geologic and hobby mineral collecting in 1982.[102] These regulations, however, were never adopted.

BLM also administers the mineral leasing laws for leasing of oil, gas, coal, and other minerals on federal lands. Such leases contain terms and stipulations to protect surface resources and other values that might be affected by mineral development. For example, the current oil and gas lease form provides:

> Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects.[103]

Thus BLM may require paleontological inventories or studies in some cases and, in theory, prevent destruction of fossils of scientific interest encountered during oil and gas development.

In a related development, the New Mexico Energy and Minerals Department has entered into a Memorandum of Understanding (MOU) with the New Mexico State Office of the BLM for "Paleontological Mitigation Procedures on BLM Managed Mining Leases in New Mexico."[104] The two agencies agreed to cooperate, in consultation with the professional community, in determining the scope and intensity of a pre-mining paleontological inventory, determining the significance of paleontological occurrences, and developing mitigation procedures. In addition, BLM agreed to determine the disposition of materials collected, to be the permitting agency for inventory and collection activities, and to incorporate appropriate paleontological stipulations into leases.[105] The MOU procedures are to remain in effect "until modified according to the National Academy of Sciences' study recommendations, or until amended to conform with nationwide interim BLM paleontology guidelines, if necessary."[106]

2. National Park Service

The National Park Service (NPS) has broad authority to manage and regulate uses of lands under its jurisdiction pursuant to its organic act.[107] National parks and monuments are to be managed "to conserve

the scenery and the natural and historic objects and the wildlife therein...in such manner...as will leave them unimpaired for the enjoyment of future generations."[108] The statute also provides that "no natural curiosities, wonders, or objects of interest shall be leased, rented, or granted to anyone on such terms as to interfere with free access to them by the public."[109]

National Park Service regulations provide that "nonfossilized and fossilized paleontological specimens,...or the parts thereof" may not be disturbed, injured, removed, etc., without a permit.[110] A specimen collection permit may be issued to reputable scientific or educational institutions or a state or federal agency under certain conditions, including a determination "that the collection is necessary to the stated scientific or resource management goals of the institution or agency."[111] Other activity permits may be issued based upon "a determination that public health and safety, environmental or scenic values, natural or cultural resources, scientific research, implementation of management responsibilities, proper allocation and use of facilities, or the avoidance of conflict among visitor use activities will not be adversely impacted."[112]

Legislation establishing certain national parks or national monuments may impose a duty on the NPS to preserve certain resources, including fossils. For example, several fossil bed national monuments have been established "to preserve [the site] for the benefit and enjoyment of present and future generations" and "to provide for the display and interpretation of scientific specimens" from the sites.[113]

The National Park Service also administers the National Natural Landmarks Program pursuant to the Historic Sites Act of 1935.[114]

IV. STATE LAWS

A. General

State regulation of fossils is typically included in legislation designed primarily for historic preservation or for protection of archaeological and other cultural resources. For some states, it is not clear whether a particular statute is intended to apply to fossils, as well as to archaeological resources (e.g., where the statute refers to objects of antiquity, or objects of historic or scientific significance). However, at least 20 states have adopted legislation that expressly regulates fossils or paleontological sites on state lands. State regulation may include permit requirements, qualifications for permit applicants, reporting requirements, and penalties for noncompliance. Some state laws appear to be modeled after the federal Antiquities Act of 1906.

Several states (including Idaho, Nevada, Utah, and Wyoming) purport to apply state permitting requirements to federal public lands as well as state public lands. A state permit requirement for federal public lands may be invalid, absent consent of the land managing agency, but there are no reported cases challenging the constitutionality

of these statutes. Nor does it appear that the states are attempting to enforce state permit requirements for federal lands.

At least three states (Idaho, Wyoming, and Utah) prohibit the export or removal of certain fossil specimens from the state without consent of the authorized state agency. Such export restrictions on specimens collected from federal public lands are probably invalid, unless incorporated into a permit issued by the federal land management agency.

B. Arizona

The Arizona statute requires a permit from the director of the Arizona state museum for excavation of any vertebrate paleontological site or any other paleontological feature located on lands owned or controlled by the state or any agency thereof.[115] Permits may only be granted to institutions, organizations, or corporations organized for scientific, research, or land use planning purposes.[116]

C. California

California prohibits excavation or removal of any "vertebrate paleontological site,...or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands."[117] Public lands are defined to include lands "owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof."[118] Any violation of this provision is a misdemeanor.[119]

D. Colorado

Colorado requires a permit from the state historical society for investigation, excavation, gathering, or removal of historical, prehistorical, and archaeological resources on state-owned lands.[120] For public or private lands not owned by the state, the society may undertake to issue permits and perform other functions authorized by the statute when requested by the owner of the land.[121] Permits may only be issued to duly qualified applicants and "only for the benefit of reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such resources."[122]

E. Florida

Florida enacted legislation to protect vertebrate paleontological sites in 1984.[123] Vertebrate fossils found on state-owned lands, including submerged lands and uplands, are declared to be property of the state.[124] Private lands may be designated as "state vertebrate paleontological sites" with the written consent of the owner.[125] Vertebrate fossil collecting on state lands or designated state vertebrate paleontological sites may be done only with a permit from

the Florida State Museum.[126] Collecting on such lands without a permit is punishable by a fine of up to $500 or imprisonment for up to six months, or both, and forfeiture of all materials collected.[127]

Although the statute does not purport to apply to nonstate-owned lands other than those voluntarily designated, it declares the legislative intent to protect and preserve vertebrate paleontological sites and to "discourage" vertebrate paleontological field investigation activities except in accordance with the provisions and the spirit of the act.[128] However, the Florida statute provides that the legislative intent is not to impede mining or construction of canals, but rather to encourage mine and heavy equipment operators to cooperate with the state in preserving its vertebrate paleontological heritage by notifying the Florida State Museum whenever vertebrate fossils are discovered during operations and by allowing such fossils to be properly salvaged.[129] Persons having knowledge of vertebrate paleontological sites are similarly encouraged to communicate such information to the museum.[130]

F. Idaho

Idaho's statute requires a permit from the board of trustees of the Idaho State Historical Society ("board") for excavation of any vertebrate paleontological deposit or site on "any public lands" in Idaho.[131] The statute is apparently intended to cover federal public lands as well as state public lands. Permits may be issued only to applicants who are qualified by experience or professional training to conduct such excavations in an approved scientific manner.[132] The board is authorized to promulgate regulations necessary to protect vertebrate paleontological sites and deposits on public lands.[133] Removal from the state of specimens collected from vertebrate paleontological sites is prohibited without the prior consent of the board.[134] As a condition to such consent, the board may require that the specimens become or remain the property of the state.[135] Any violation of the statute is a misdemeanor, and conviction requires forfeiture of all materials acquired or discovered.[136]

G. Kentucky

It is unclear whether Kentucky's archaeological statute applies to fossils. Kentucky's 1962 legislation declares a public policy "to preserve archaeological sites and objects of antiquity for the public benefit and to limit exploration, excavation and collection of such matters [sic] to qualified persons and educational institutions possessing the requisite skills and purpose to add to the general store of knowledge concerning history, archaeology and anthropology."[137] "Object of antiquity" is defined to mean "a ruin, monument, relic, bone deposit, artifact or any product of human workmanship of Indians or any aboriginal race or pioneers.[138] It is not clear whether "bone deposit" is intended to refer to human remains or any vertebrate deposit. A permit from the Anthropology Department of the University of Kentucky is required to explore or excavate archaeological sites or

objects of antiquity on lands owned by the state or any political subdivisions.[139] Permits are to be regularly granted for work undertaken for the benefit of reputable museums, universities, colleges or other recognized scientific or educational institutions with a view to promoting the knowledge of archaeology or anthropology.[140] Any person who discovers an archaeological site or object of antiquity in the course of construction work or otherwise is to report such discovery to the department.[141] The department may enter into contracts or cooperative agreements with private landowners relating to the preservation and proper exploration of any archaeological site or object of antiquity located on private land.[142]

H. Louisiana

Louisiana's 1974 statute declares a public policy "to protect and preserve historic properties, artifacts, treasure troves, and objects of antiquity which have historical value or which are of interest to the public," including fossil deposits.[143] However, the statute seems to be primarily concerned with archaeology and sunken treasure. The Louisiana Archaeological Survey and Antiquities Commission is authorized to promulgate regulations concerning the salvage and study of state historic and prehistoric remains on state lands.[144] The statute "encourages" private landowners to notify the commission at least 90 days prior to knowingly excavating or destroying any remains or artifacts to allow professional supervision by the commission.[145]

I. Maine

Although an earlier Maine statute regulated both archaeological artifacts and natural science specimens on state lands, this statute was repealed and replaced by a 1981 statute that only applies to archaeological objects.[146]

J. Massachusetts

Massachusetts requires a permit from the state archaeologist for field investigations on lands owned by the state or its political subdivisions or on historic or archaeological landmarks.[147] Any discovery of any archaeological or paleontological site on any lands in the state is to be reported to the state archaeologist and all reasonable steps must be taken to secure its preservation.[148]

K. Montana

Montana's statute requires an antiquities permit from the state historic preservation officer for excavation or removal of paleontological remains on state-owned lands.[149] "Paleontological remains" are defined as "fossilized plants and animals of a geological nature found upon or beneath the earth or under water which are rare or

critical to scientific research."[150] Thus it would appear that no permit is required for fossils that are not deemed "rare" or "critical" to science. Antiquities permits may only be granted for work to be undertaken by reputable scientific, educational or related institutions.[151]

L. Nevada

Nevada requires a permit to explore or excavate historic or prehistoric sites on federal or state lands.[152] "Prehistoric site" is defined to include any paleontological site or deposit, fossilized footprint and other impressions.[153] For federal lands, the Nevada statute purports to require applicants to also obtain a permit under 16 U.S.C. §§ 431-433 (the federal Antiquities Act).[154] However, the state statute's permitting requirements for fossils are much broader than those of the federal act, as interpreted by the Department of the Interior. Permittees may be required to give up to 50 percent of all materials discovered to the state for deposit with the state museum.[155]

M. New Mexico

The New Mexico Cultural Properties Act, NMSA 18-6-1 to 16-6-17 (1978) as amended, does not apply to fossils. "Cultural property" subject to the act is defined to include" a structure, place, site or object having historic, archaeological, scientific, architectural or other cultural significance."[156] The statute is interesting in that it requires a permit for excavations using mechanical earth moving equipment of archaeological sites located on private land.[157] However, a landowner is not required to obtain a permit for personal excavation on his own land.[158] Archaeological specimens collected under such permits remain the property of the landowner.[159]

N. New York

New York requires a permit from the Commissioner of Education for collecting "any object of archaeological and paleontological interest" located on state lands.[160] Any violation of this provision is a misdemeanor.[161] The discovery of such objects is to be reported to the commissioner by the state department or agency having jurisdiction over such lands.[162]

O. North Dakota

North Dakota's statute requires a permit from the superintendent of the state historical board for excavations or investigations of cultural resources on lands owned by any instrumentality of the state.[163] The statute defines "cultural resources" to include paleontological sites and materials.[164] A permit is also required for evaluation or mitigation activities pursuant to the National Historic Preservation Act.[165] However, the statute is not intended

to restrict landowners in exploring or excavating cultural resources on their own land.[166]

P. South Carolina

The South Carolina Heritage Trust Program[167] provides for the designation of "Heritage Preserves" and "Heritage Sites" to protect natural areas and natural features for various purposes, including paleontological research. In addition, the 1982 South Carolina Underwater Antiquities Act[168] requires a license from the South Carolina Institute of Archaeology and Anthropology for operations involving submerged archaeological or paleontological sites.[169]

Q. South Dakota

South Dakota's archaeological resources statute[170] does not appear to apply to paleontology. However, the South Dakota historic preservation statute defines "historic property" to include any object, area or site that is significant in the paleontology of the state, its communities, or the nation.[171]

R. Tennessee

Tennessee regulates fossils on state lands by requiring a permit from the Tennessee Division of Archaeology for excavation of archaeological or paleontological sites on state lands.[172] If paleontological or archaeological sites are discovered on state lands during construction work, state agencies are required to cooperate with the division of archaeology to obtain data or prevent destruction of the sites.[173]

S. Utah

Utah's statute requires a permit from the Division of State History for exploration or excavation of paleontological deposits on any state or federal lands in Utah.[174] The statute prohibits removal from the state of any materials from such deposits without the consent of the Division.[175] As a condition to granting its consent, the Division may require that a portion of the relics, materials, or deposits remain the property of the state or county in which they were located.[176] The Division is authorized to promulgate rules to protect paleontological deposits of the state from vandalism or injury.[177] Any violation of the statute or the rules promulgated by the Division is a misdemeanor and convictions result in forfeiture to the state of all materials discovered.[178] As noted above, the applicability of the permit, penalty, and forfeiture provisions to federal public lands is questionable.

The statute requires that any discovery of paleontological specimens on state lands be promptly reported to the Division of State History. The statute also states: "It is the intention of the legislature that discovery on privately owned lands of sites or specimens should be immediately reported to the division of state

history and that field investigations should be discouraged except in accordance with this act."[179]

Utah's statute also provides for the designation of "state paleontological landmarks." Private lands may be so designated only with the written consent of the owner.[180]

T. Virginia

The Virginia Antiquities Act[181] does not appear to apply to paleontology. However, the Virginia Cave Protection Act requires a permit from the Department of Conservation and Historic Resources for removal of any paleontological feature of any cave.[182]

U. Wyoming

Wyoming's statute was enacted in 1935. It requires a permit from the state board of land commissioners for excavation of any paleontological deposits on any public lands, either state or federal.[183] The board is authorized to promulgate and enforce regulations necessary to protect paleontological deposits from vandalism or injury.[184] Removal of such deposits from the state is prohibited except with the consent of the board. As a condition to such consent, the board may require that the materials forever remain the property of the state of Wyoming.[185] Any violation of the statute is a misdemeanor, with a maximum fine of $100 or six months imprisonment, or both, and forfeiture of all materials discovered.[186]

V. OWNERSHIP OF FOSSILS IN SPLIT ESTATE SITUATIONS

The question of fossil ownership may arise where the mineral estate is severed, or owned separately, from the surface estate. This is a very common situation in the western states and is sometimes referred to as the "split estate" situation. The severed mineral estate may be owned privately or by the federal government. The extensive severed mineral estate held by the federal government in the western states resulted primarily from mineral reservations in homestead patents. Today the federal government manages over 100 million acres of severed mineral estate in which all minerals were reserved to the United States plus over 20 million acres in which specific leasable minerals such as coal, oil and gas, or phosphate were reserved.[187]

The Solicitor's Office of the Department of the Interior has concluded that federal mineral reservations generally do not include fossils.[188] Thus fossils would belong to the private surface owner where the mineral estate is federally owned. While there are no reported cases dealing with fossils in federal mineral reservations, at least one case has construed a private mineral reservation to include petrified wood.[189]

Appendix R

NOTES

[1]Legislation to regulate vertebrate fossil collecting on federal and Indian lands was introduced in 1983 by Senator Pressler (S.D.), but died in the Senate Energy and Natural Resources Committee. See Paleontological Resources Conservation Act of 1983, S.1569, 98th Cong., 1st Sess., 129 Cong. Rec. 93 (1983).

[2]See Section II.B.2 infra on National Park Service.

[3]See Section II.G. infra on the Materials Act.

[4]Public Law 34-209, 16 U.S.C. §§ 431-433. For readers unfamiliar with legal citations, laws enacted by Congress (also referred to as public laws, statutes, or legislation) are codified in the United States Code (U.S.C.) and cited by title and section number. Regulations (or "rules") promulgated pursuant to these statutes are published in the Federal Register and later codified in the Code of Federal Regulations (C.F.R.), also cited by title and section number. Valid regulations adopted by an agency pursuant to a statute have the full force and effect of law.

[5]16 U.S.C. § 433.

[6]Id.

[7]16 U.S.C. § 432.

[8]Id.

[9]43 C.F.R. §§ 3.5, 3.10, 3.17 (1985).

[10]16 U.S.C. § 431.

[11]Proclamation 1313, 39 Stat. 1752 (1915).

[12]H. R. Rep. No. 2224, 59th Cong., 1st Sess. (1906); S. Rep. No. 3937, 59th Cong., 1st Sess. (1906).

[13]Memorandum of October 12, 1956, from Assistant Solicitor, National Parks, to Chief Clerk. It is interesting to note that this opinion was apparently issued in response to a brief submitted by the American Geological Institute maintaining that fossils were not intended to be covered by the permitting provisions of the Antiquities Act. Thirty years later, paleontologists are raising the same problems with permitting, in spite of the fact that the Solicitor's Office has reversed itself on interpretation of the Antiquities Act.

[14]Memorandum of January 19, 1977, from Deputy Solicitor to Assistant Secretary for Fish, Wildlife & Parks, 6. [Emphasis added.] This advice was reiterated by the Solicitor in a more recent opinion, which advised "that the Antiquities Act not be relied on as authority for any fossil management program administered by BLM." Memorandum of January 17, 1986, from Associate Solicitor, Energy and Resources, to Director, Bureau of Land Management, 6.

[15]499 F.2d 113 (9th Cir. 1974).

[16]Id. at 114.

[17]Id. at 115.

[18]Id. at 115.

[19]United States v. Farisch [sic] Jenkins, No. CR-74-63-BLG, U.S. District Court, Montana District, Billings Division, January 13, 1975. As the later Smyer case indicates, the outcome of this case might have been different in a Tenth Circuit state such as Wyoming.

[20]596 F. 2d 939 (10th Cir. 1979).

[21]Id. at 941.

[22]18 U.S.C. §§ 641, 1361.

[23]607 F.2d 269 (9th Cir. 1979).

[24]Id. at 271.

[25]49 Federal Register, October 15, 1984.

[26]U.S.C. §§ 470aa-47011.

[27]16 U.S.C.. § 470bb(1).

[28]Public Law 74-292, 16 U.S.C. §§ 461-467.

[29]16 U.S.C. §§ 461-467.

[30]Public Law 89-65, 516 U.S.C. §§ 470-470t.

[31]36 C.F.R, Part 62 (1985).

[32]While the Historic Sites Act may not be the appropriate authority for natural landmarks that are unrelated to cultural or historic resources, ample authority exists under other statutes for such a program.

[33]36 C.F.R. § 62.1 (1985).

[34]36 C.F.R. § 62.2 (1985).

[35]36 C.F.R. § 62.4 (1985).

[36]Public Law 86-523, 16 U.S.C. §§ 469-469c, as amended.

[37]Public Law 93-291, 16 U.S.C. §§ 469-469c.

[38]Id.

[39]Public Law 91-190, 42 U.S.C. §§ 4321-4347, as amended.

[40]NEPA § 102(C), 42 U.S.C. § 4332(C).

[41]40 C.F.R § 1508.14 (1985).

[42]40 C.F.R. § 1508.27 (1985) [Emphasis added].

[43]42 U.S.C. § 4332(C).

[44]E.g., properly determined the need for an EIS and prepared an adequate EIS.

[45]Strycker's Bay Neighborhood Council v. Karlin, 444 U.S. 223 (1980).

[46]Id.

[47]Archaeologists are often heavily involved in preparation of EISs, primarily as a result of Executive Order No. 11593, 3 C.F.R. § 154 (1985), which detailed federal agency responsibilities under NEPA and the National Historic Preservation Act of 1966. Since no comparable authority exists for paleontology, the agencies are left to their discretion in determining the scope of any paleontological inventory and impact analysis on fossil sites in any particular EIS.

[48]Public land minerals subject to disposal under the leasing system include coal, oil, gas, oil shale, potassium, and phosphate.

[49]Public land minerals subject to disposal under the Materials Act include common varieties of sand, stone, gravel, clay, etc. See Section II.G.

[50]Earl Douglas, 44 L.D. 325, 326 (1915).

[51]Public Law 87-713, 30 U.S.C.. § 611.

[52]Public Law 87-713, § 2.

[53]43 C.F.R. Subpart 3809 (1985).

[54]36 C.F.R. §§ 228.1 - 228.15 (1985).

[55]It is interesting to compare the permit requirements for mining activities under the 1872 Mining Law with those proposed for fossil collecting. The BLM mining regulations require no permit or notice for "casual use," defined as "activities ordinarily resulting in only negligible disturbance" of the lands and resources. 43 C.F.R. § 3809.0-5(b) (1985). A notice is required for operations that cause a cumulative disturbance (including access) of five acres or less per year. 43 C.F.R. § 3809.1-3. An approved plan of operations is only required for those operations that disturb more than five acres per year. C.F.R. § 3809.1-4. Comparable Forest Service regulations require a notice for any operations which "might" cause disturbance of surface resources, and an approved plan of operations for those that will likely cause "significant" disturbance of surface resources. 36 C.F.R. § 228.4 (1985).

[56]43 C.F.R. § 3809.2-2 (1985). [Emphasis added.]

[57]36 C.F.R. § 228.8 (1985).

[58]Public Law 87-713, § 2.

[59]43 C.F.R. § 3622 (1985).

[60]43 C.F.R. § 3622.4 (1) (1985).

[61]43 C.F.R. § 3622.4 (2) (1985).

[62]43 C.F.R. § 3622,4(a)(4) (1985).

[63]43 C.F.R. § 3622.4(b) (1985).

[64]43 C.F.R. § 3622.4 (3) (1985).

[65]43 C.F.R., Part 3610 (1985).

[66]30 U.S.C. §§ 601,602.

[67]30 U.S.C. § 601.

[68]Id., See regulations at 43 C.F.R., Subpart 3621 (1985).

[69]Public Law 95-87, 30 U.S.C. § 1201-1328.

[70]SMCRA § 507(B)(13), 30 U.S.C. § 1257(b)(13).

[71]Preamble to final regulations, 44 Federal Register 15028 (March 13, 1979). See also Memorandum of July 29, 1981, from Regional Solicitor, Rocky Mountain Region to Regional Director, OSM, on "Paleontological Resources and Mine Plan Review."

[72]SMCRA § 522(a)(3)(B), 30 U.S.C. § 522(a)(3)(B).

[73]16 U.S.C. § 551.

[74]Id.

[75]36 C.F.R. §§ 261.1a, 261.9 (1985). Special use permit regulations are found at 36 C.F.R. 251.50 (1985).

[76]36 C.F.R. § 261.2 (1985).

[77]Frank Watson pleaded no contest in 1985 to a charge of violating these Forest Service regulations by collecting fossils on the Buffalo Gap National Grassland. He was fined $100. Letter dated September 30, 1985, from Walter J. Bradskey (attorney for Watson) to Professor Farish A. Jenkins, Jr.

[78]51 Federal Register 30355 (August 26, 1986). "Interim" rules, unlike proposed rules, are effective immediately. Comments submitted during the 30-day comment period will be considered in developing the final rule.

[79]Id.

[80]36 C.F.R. § 261.53(c),(d) (1985).

[81]36 C.F.R. § 261.1a (1985).

[82]36 C.F.R. § 296.4 (1985).

[83]Public Law 94-579, 43 U.S.C. §§ 1701-1782.

[84]FLPMA § 302(b), 43 U.S.C. § 1732(b). BLM regulations implementing the general permit provisions of FLPMA are codified at 43 C.F.R. Part 2920 (1985). FLPMA authorizes the Secretary to issue regulations necessary to implement the provisions of the Act "with respect to the management, use, and protection of the public lands, including the property located thereon." 43 U.S.C. § 1733(a). Any person who "knowingly and willfully violates any such regulation which is lawfully issued" pursuant to FLPMA is subject to a fine of up to $1,000 or imprisonment of up to 12 months, or both.

[85]Id.

[86]FLPMA § 302(a), 43 U.S.C. § 1732(a).

[87]FLPMA § 103(C), 43 U.S.C. § 1702(c) [Emphasis added].

[88]FLPMA § 102(a)(8), 43 U.S.C. § 1701(a)(8).

[89]FLPMA § 1701(a)(9), 43 U.S.C. § 1701(a)(9).

[90]FLPMA § 102(b) 43 U.S.C. § 1701(b). The only authority for disposal of fossils for commercial purposes appears to be the Materials Act, which requires payment of "adequate compensation." (See section II.G supra.)

[91]FLPMA § 201(a), 43 U.S.C. § 1711(a) [Emphasis added].

[92]FLPMA §103(a) 43 U.S.C. § 1702(a).

[93]Examples include Mountain Pass Dinosaur Trackway, 1,580 acres; Rainbow Basin-Owl Canyon, 2,426 acres; Marble Mountain Fossil Site, 500 acres; Coyote Mountain Fossil Site, 1,360 acres; North Panoche Hills, 18,000 acres; Webber Canyon, 160 acres. [List provided by Carl Barna of BLM on April 25, 1985.]

[94]See 43 C.F.R., Subpart 8223 (1985).

[95]43 C.F.R. § 8223.0-5 (1985).

[96]50 Federal Register 42122 (October 17, 1985).

[97]Public Law 98-603.

[98]43 C.F.R. § 8224.1(a).

[99]Id.

[100]These include Cleveland-Lloyd Dinosaur Quarry in Utah, 80 acres; Bridger Fossil Area in Montana, 160 acres; Bug Creek Fossil Area in Montana, 800 acres; Garden Park Fossil Area in Colorado, 160 acres; and Hagerman Fauna Sites in Idaho, 3,875 acres. [List provided by Carl Barna of BLM.]

[101]43 C.F.R. § 8360 (1985).

[102]47 Federal Register 35914 (August 17,1982).

[103]Offer to Lease and Lease for Oil and Gas, Form 3100-11 (March 1984), §6 [emphasis added].

[104]MOU dated August 27, 1985.

[105]BLM's only authority for conditioning leases with paleontological stipulations is the Federal Coal Leasing Amendments Act of 1975, one of the few authorities not cited in the MOU.

[106]MOU, 2.

[107]16 U.S.C. § 1,3.

[108]16 U.S.C. § 1.

[109]16 U.S.C. § 3.

[110]36 C.F.R. § 2.1(a) (1985).

[111]36 C.F.R. § 2.5(b) (1985).

[112]36 C.F.R. § 1.6 (1985).

[113]Public Law 91-60, 83 Stat. 101 (Florissant Fossil Beds National Monument); Public Law 92-537, 86 Stat. 1069 (Fossil Butte National Monument); Public Law 89-33, 79 Stat. 123 (Agate Fossil Beds National Monument).

[114]16 U.S.C. §§ 461-467 and 36 C.F.R., Part 62. See Section II.C supra.

[115]Ariz. Rev. Stat. Ann. § 41-841, 842.

[116]Ariz. Rev. Stat. Ann. § 41-842.

[117]Cal. Publ. Res. Code § 5097.5.

[118]Id.

[119]Id.

[120]Colo. Rev. Stat. § 24-80-406.

[121]Colo. Rev. Stat. § 4-80-408.

[122]Colo. Rev. Stat. § 4-80-406.

[123]Fla. Stat. Anno. 267.15-267.153.

[124]Fla. Stat. Anno. 267.15(3).

[125]Fla. Stat. Anno. 267.151.

[126]Fla. Stat. Anno. 267.152(1).

[127]Fla. Stat. Anno. 267.152(2).

[128]Fla. Stat. Anno. 267.15(1).

[129]Id.

[130]Id.

[131]Idaho Code § 67-4120.

[132]Id.

[133]Idaho Code § 67-4121.

[134]Id.

[135]Id.

[136]Idaho Code § 67-4122.

[137]Ky. Rev. Stat. Ann. § 164.705.

[138]Ky. Rev. Stat. Ann. § 164.710.

[139]Ky. Rev. Stat. Ann. § 164.720(1).

[140]Ky. Rev. Stat. Ann. § 164.720(2).

[141]Ky. Rev. Stat. Ann. § 164.730.

[142]Ky. Rev. Stat. Ann. § 164.735.

[143]La. Rev. Stat. Ann. § 41:1601.

[144]La. Rev. Stat. Ann. § 41:1607.

[145]La. Rev. Stat. Ann. § 41:1610.

[146]Me. Rev. Stat. Ann. tit. 27, § 371-378.

[147]Mass. Gen. Laws Ann. ch. 9, § 27C.

[148]Id.

[149]Mont. Code Ann. § 22-3-432.

[150]Mont. Code Ann. § 22-3-421(5).

[151]Mont. Code Ann. § 2-3-432.

[152]Nev. Rev. Stat. § 381.197.

[153]Nev. Rev. Stat. § 381.195.

[154]Nev. Rev. Stat. § 381.199.

[155]Nev. Rev. Stat. § 381.207.

[156]N. M. Stat. Ann. § 18-6-3B.

[157]N. M. Stat. Ann. § 18-6-11A.

[158]N. M. Stat. Ann. § 18-6-11D.

[159]N. M. Stat. Ann. § 18-6-11C.

[160]N.Y. Educ. Law § 233.4 (McKinney 1969).

[161]Id.

[162]Id.

[163]N. D. Cent. Code § 55-03-00.1

[164]N. D. Cent. Code § 55-03-00.1.

[165]N. D. Cent. Code § 55-03-01.

[166]N. D. Cent. Code § 55-03-05.

[167]S.C. Code Ann. § 51-17-10 - 52-17-140 (1985 Cum. Supp.).

[168]S.C. Code Ann. § 54-7-400 to 54-7-540 (1985 Cum. Supp.).

[169]S.C. Code Ann. § 54-7-440.

[170]S.D. Codified Laws Ann. § 1-20-17 to 1-20-37 (1985).

[171]S.D. Codified Laws Ann. § 1-19A-2 (1985).

[172]Tenn. Code Ann. § 11-6-105 (1986 Supp.).

[173]Tenn. Code Ann. § 11-6-107.

[174]Utah Code Ann. § 63-18-25.1(1) (1986 Interim Supp.).

[175]Utah Code Ann. § 63-18-25.1(3).

[176]Id.

[177]Utah Code Ann. § 63-18-25.1 (2).

[178]Utah Code Ann. § 63-18-25.1 (4).

[179]Utah Code Ann. § 63-18-27 (1977).

[180]Utah Code Ann. § 63-18-26 (1985 Supp.).

[181]Va. Code Ann. § 10-150.1 to 10.150.10. (1985 Repl. Vol.).

[182]Va. Code Ann. § 10-150.16B (1985 Repl. Vol.).

[183]Wyo. Stat. § 36-1-114 (1977).

[184]Id.

[185]Wyo. Stat. § 36-1-116 (1977).

[186]Wyo. Stat. § 36-1-116 (1977).

[187]Department of the Interior, PUBLIC LAND STATISTICS 1983, Tables 13, 20.

[188]Memorandum of January 17, 1986, from Associate Solicitor, Energy and Resources, to Director, Bureau of Land Management, 3.

[189]In Spurlock v. Santa Fe Pacific Railroad Co., 694 P.2d 299 (Ariz. App. 1984), the Arizona court of appeals held as a matter of law that helium, nitrogen, potash, industrial clay, and petrified wood are minerals, and were reserved by a general mineral reservation of "all oil, gas, coal and minerals whatsoever, already found or which may hereafter be found." The court noted that all are inorganic, commercially valuable substances which are distinct from the soil itself.

National Academy Press

The National Academy Press was created by the National Academy of Sciences to publish the reports issued by the Academy and by the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all operating under the charter granted to the National Academy of Sciences by the Congress of the United States.

APPENDIX Q

NATIONAL NATURAL LANDMARKS PROGRAM

The National Park Service maintains an active program of designating sites or areas of special natural significance known as NATIONAL NATURAL LANDMARKS. Approximately 550 such designations have been made to date, about half of which are on public lands and half are privately held or have a mixture of public and private ownership. A Park Service summary statement of the Program is:

NATIONAL PARK SERVICE
Interagency Resources Division
Natural Areas Survey Branch
NATIONAL NATURAL LANDMARKS PROGRAM

PROGRAM PURPOSE

The National Natural Landmarks Program was established in 1962 by the Secretary of the Interior to encourage preservation of the best remaining examples of the major biotic communities and geologic features in the continental United States, Puerto Rico, the Virgin Islands, Hawaii, Guam, the Commonwealth of the Northern Marianas, American Samoa, and the Trust Territory of the Pacific Islands. It is the only natural areas program of national scope to identify and recognize best examples of both biological and geological features without regard to site ownership or management.

In broader terms, the Program seeks to encourage the preservation of natural diversity, which comprises species, biotic communities, and their associated habitats, and may also be defined to include landforms, geologic structures, fossil deposits, and other types of features that compose the natural landscape. The preservation of natural diversity has important scientific, economic, educational, recreational, and aesthetic value, and is accomplished primarily through the conservation of natural areas that retain samples of natural diversity. Natural areas are linked further to the functioning of the biosphere, upon which man's survival ultimately is dependent.

PROGRAM APPROACH

Because the character of natural diversity is regionally distinct

according to broad patterns of physiography, the Natural Areas Survey Branch is completing inventories of the principal known natural areas in each of the 33 physiographic provinces, or natural regions, of the nation. These studies are compiled through original research, review of existing surveys, and consultation, and represent a regional inventory and classification of the Nation's natural heritage. This growing data base is shared on request with individuals; Federal, State, and local agencies of government; and scientific and conservation organizations.

The best examples of the various types of natural features identified in the inventories are publicly recognized as nationally significant through designation by the Secretary of the Interior as National Natural Lankmarks. In addition, National Park Service employees and volunteers monitor designated sites on a regular basis to evaluate their resource condition and report upon imminent threats or existing damage to their nationally significant features.

Wherever possible, the Natural Areas Survey Branch functions in close coordination with State natural areas inventory programs. Whereas State programs compile survey data on examples of natural diversity at a finer scale and undertake to preserve a more comprehensive selection of natural features within the context of individual States, the National Natural Landmarks Program identifies and seeks to encourage the preservation of major components of natural diversity within large natural regions. This complementary Federal/State relationship serves effectively to combine public resources in an effort to recognize and conserve vital examples of our nation's natural landscape.

A significant number of the National Natural Landmarks have been so designated because of their paleontological deposits. A few examples are given below:

CLEVELAND-LLOYD DINOSAUR QUARRY (Emery County, Utah): The quarry has provided more than 10,000 fossil bones from at least seven different genera of the Jurassic Period and representing more than 60 individual animals. Restricted access. Owner: Federal.

BUG CREEK FOSSIL AREA (McCone County, Montana): The site contains small mammal fossils. Taken together with the Hell Creek Fossil Area, the two sites span the decline of the dinosaurs and beginning of mammalian dominance. Owner: Federal.

FOSSIL CORAL REEF (Genesee County, New York): An exposed fossil site in an abandoned limestone quarry surrounded by woodland. It is extremely rich in fossil coral specimens. Owner: Private.

GAY HEAD CLIFFS (Dukes County, Massachusetts): On the western tip of Martha's Vineyard. An unusual cross section of Raritan and Magothy sediments of Cretaceous age and fossil-bearing sands of Miocene and either Pliocene or Pleistocene ages that rise as much as 150 feet above

sea level, resting on the continental shelf and detached from the mainland. Owner: Municipal.

RANCHO LA BREA (Los Angeles County, California): World-famous natural asphalt tar pits in which Pleistocene animals became entrapped in their quest for fresh water. Owner: Municipal.

GARDEN PARK FOSSIL AREA (Fremont County, Colorado): One of the oldest and richest sites containing dinosaur, fish, crocodile, turtle, and mammal fossils in the United States. Owner: Federal.
MORRISON FOSSIL AREA (Jefferson County, Colorado): First major site for the discovery of giant dinosaur fossil bones in North America (1877). Owner: Municipal, Private.

DINOSAUR TRACKWAY (Hartford County, Connecticut): One of the largest known exposures of dinosaur tracks on a single bedding plane. About 1000 tracks, belonging to at least three types of reptiles have been identified. Owner: State.

OHIO CORAL REEF (FALLS OF THE OHIO): Classic examples of a Silurian and Devonian coral community from which nearly 900 species have been founded on specimens collected here. Owner: State.

APPENDIX R

LEGAL HISTORY AND INTERPRETATIONS

LAWS AND REGULATIONS PERTAINING TO FOSSILS

I. INTRODUCTION

There is no federal legislation designed specifically for protection of fossils on federal public lands,[1] as there is for archaeological resources. Nevertheless, ample statutory authority exists for the various federal land management agencies to protect, manage and dispose of fossils on public lands. However, with few exceptions, existing statutes do not impose a duty on federal agencies to manage or preserve fossils on public lands. Among the exceptions to this general statement are specific federal statutes establishing national monuments for purposes of preserving fossil remains.[2] Thus the issue of whether federal agencies should regulate scientific or amateur fossil collecting by means of a permit system is largely a policy question, rather than a legal question. Fossil collecting for commercial purposes, however, probably requires some kind of permit system under existing law to ensure payment of adequate compensation.[3]

With few exceptions, neither archaeological nor paleontological resources located on private lands are regulated or protected by federal or state legislation. The exceptions include voluntary designation of private sites as national or state landmarks, certain prohibitions against federal actions or undertakings (e.g., federal construction projects or federally funded or licensed projects) that might destroy certain materials, and unsuitability designation for surface mining. Ownership of paleontological and archaeological resources located on private lands rests with the private landowner.

Sections II and III of this appendix summarize both general and agency-specific statutes that may apply to fossils on federal public lands. Brief summaries of laws designed primarily to protect archaeological or historic resources are included both for comparative purposes and because there may be some uncertainty about their applicability to fossils. Section IV summarizes state laws that pertain to fossils. Section V discusses ownership of fossils on "split estate" lands where the surface estate and mineral estate are in separate ownership.