

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550

May 21, 1971

RECEIVED

MAY 24 1971

E. H. S.

Mr. Don Crabtree  
The Museum  
Idaho State College  
Pocatello, Idaho 83201

Dear Mr. Crabtree:

We hope you will assist the National Science Foundation again in the evaluation of applications. A brief critical review of the enclosed proposal would be of great value to us in determining its final disposition. As you know, the fact that you have reviewed this proposal will be held confidential. We may, however, summarize or paraphrase certain suggestions and criticisms and transmit them anonymously to the applicant if we believe they would be helpful and you do not object.

Along with the proposal we enclose rating sheets (one copy to be returned and one for your files) and a postage-paid return envelope. The proposal itself need not be returned. Please mail the rating sheet by the date indicated, if possible.

Again let me express our appreciation of your help.

Sincerely yours,



John B. Cornell  
Program Director for  
Anthropology

Enclosures

PLS986, Eddy

ce. 2.4.1971

14/3

**DIVISION OF SOCIAL SCIENCES  
NATIONAL SCIENCE FOUNDATION  
PROPOSAL RATING SHEET**

Please evaluate this proposal for scientific merit including the competence and potential of the investigator(s). Comments are also solicited on the appropriateness of the budget for carrying out the work proposed. An overall rating for merit as well as a brief discussion will be appreciated.

Proposal No.: P1 S0986-A  
Investigator: Frank W. Eddy  
Institution: U Colorado  
Please return  
if possible by:

Comments (Continue on additional sheet if necessary)

**OVERALL RATING**

- EXCELLENT
- VERY GOOD
- GOOD
- FAIR
- POOR

**Signature of Reviewer:**

**Institution**

Ce 224/1072

A Proposal to the  
National Science Foundation  
for support of

CHIMNEY ROCK ARCHAEOLOGICAL PROJECT


Name and Address of Institution: The Regents of the  
University of Colorado  
Boulder, Colorado 80302

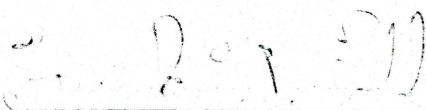
Desired Starting Date: July 1, 1971

Amount Requested from NSF: \$2,845

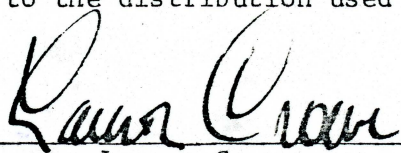
Time Period for which Support is Requested: One year

Principal Investigator: Frank W. Eddy  
Assistant Professor  
Dept. of Anthropology  
University of Colorado  
Boulder, Colorado 80302  
Telephone: 303-443-2211, Ext. 8188

  
\_\_\_\_\_  
Alice M. Brues, Chairman  
Department of Anthropology

  
\_\_\_\_\_  
Frank W. Eddy  
Principal Investigator

I certify that the distribution of costs between the direct and indirect categories as shown in the proposal conforms to the usual accounting practices of the institution and to the distribution used by the cognizant Federal audit agency.

  
\_\_\_\_\_  
Lawson Crowe  
Vice President for Research  
and  
Dean of the Graduate School

cc. 2.4.107.3

### Abstract

The following proposal is a request for funds to purchase a microscope, accessories, and camera attachment suitable for the study of the manufacture and wear characteristics to be found on prehistoric artifacts collected through a United States Forest Service (USFS) sponsored research project conducted at Chimney Rock Mesa in the San Juan National Forest, southwestern Colorado. The request is for funds to supplement the government contract of \$8,900 already issued for site survey (inventory), excavations, a laboratory assistant, and publication of the research results. The supplemental funds are needed because the USFS contract does not cover capital outlay for equipment, such as a microscope.

If granted, the focus of the student-involved laboratory work will be the close scrutiny of the recovered artifacts to determine the methods of manufacture, use of the tools, and the nature of the raw materials from which they were made. Many of the relevant attributes consist of microscopic scratches, holes, cracks, abrasions, and polish imprinted upon the prehistoric objects either at the time of production or subsequently during use. Traditionally this type of inspection has been either ignored or conducted with a small-field, low-powered hand lens (6X to 10X). However, recent advances in archaeological laboratory techniques have been toward more detailed and high-powered inspection of manufacture and wear characteristics rather than just gross artifact shapes upon which identifications have been based in the past.

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The Chimney Rock Archaeological Project is a program of research sponsored by the University of Colorado and supported by contract from the United States Forest Service (USFS) in a portion of the Pagosa Springs District of the San Juan National Forest located in southwestern Colorado. The program is designed to investigate research problems in prehistoric subsistence, settlement, demography, land use, and paleo-ecology.

The USFS contract of \$8,900 covers the cost of site survey (inventory) and four excavations, as well as the publication of a technical report describing the research findings of the field work. However, no capital outlay for equipment was included in the USFS agreement. Therefore, this request is made to obtain funds for microscope equipment necessary for laboratory analysis of the recovered specimens. If this request is granted, the focus of the microscopic work will be on the close scrutiny of the artifacts to determine methods of manufacture, use of the tools, and the nature of the raw materials from which they were made. Many of the relevant attributes consist of microscopic scratches, holes, cracks, abrasions, and polish imprinted upon the prehistoric objects either at the time of production or subsequently during use. Traditionally this type of inspection has been either ignored or conducted with a small-field, low-powered hand-lens (6X to 10X). However, recent advances in archaeological laboratory techniques have been toward more detailed and high-powered inspection of manufacture and wear characteristics rather than just gross artifact shapes upon which identifications have been based in the past (Semenov 1964). Pioneer work in Russia has stressed the need for at least low-power magnification, whereas recent work in this country has moved towards enlargement several hundred times over the original object (MacDonald and Sanger 1968).

If a microscope is available, the entire collection of thousands of recovered artifacts will be passed under the binocular for preliminary low-powered (10X to 20X) scanning. In this phase of the research, observations will be made covering technical, wear, and stylistic characteristics present on each piece. Each of these attributes, where present, will be recorded on a format suitable for entry on data punch cards and eventual computer processing following the cluster analysis procedures of numerical taxonomy (Sokal 1966). Based on the first scanning, likely artifacts will be isolated for subsequent high-powered examination and photomicrography aimed at close scrutiny of wear patterns. Particularly, the

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photographs will allow definition of wear, permitting a reconstruction of the tool use (i.e. cutting, pounding, sawing, whittling, reaming, and others). Furthermore, these photographs will provide a fixed image, which will have additional use as a map of wear striations from which accurate measurements of direction (angle), length, and width can be made. By this means, quantitative assessments of the nature of worn tool attrition can be calculated.

Semenov (1964), as well as MacDonald and Sanger (1968:238), has emphasized the need for binocular microscopes for studying the curved surfaces of opaque artifacts in reflected light. "As they give stereoscopic vision, they allow at comparatively small magnifications examination of objects both in the flat and in depth, a clear view of surface changes, detection of chip-marks, lines, scars, and cracks, and comparison of worn and unworn parts of the surface" (Semenov 1964:22). The use of magnesium powders (magnesium oxide) or colorizers (India ink, methyl violet, silver nitrate) to block light is recommended by Semenov (1964:24) in those cases where translucent materials (such as the glassy cryptocrystalline rocks) tend to pass light and thereby distort the reflected image, which is best seen in a strong, low angle cross-light.

The long-term goal of anthropology, of which archaeology is a part, is the understanding of human cultural behavior. More particularly, the archaeologist seeks to study past behavior in terms of cultural persistence and change through time and space. However, since the observer is removed in time from his subject matter, the processes of inquiry rest on inferences derived from the enduring physical artifacts. Therefore our research is based on fossil behavior of a restricted kind, that is, the imperfectly preserved tool technology. One fruitful means of advancing our understanding of past human behavior, then, is through ever more intensive inspection of the simple tools of ancient man.

By the end of the USFS grant period -- an indefinite length of time dependent entirely on the financial resources and patience of the U.S. Forest Service -- I would expect to have reconstructed many of the technical processes of the prehistoric Chimney Rock Anasazi peoples between the 10th and 12th centuries. I am particularly interested in their subsistence technology as it was adjusted to making a living on the mesa-top uplands of southwestern Colorado through corn agriculture. In order to understand this tool technology and its subsistence functions, reliable use inferences must be drawn from artifact wear patterns. In the past

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the archaeologist has relied upon comparisons with similarly shaped tools in use by modern primitive man or some facile analogy with his own contemporary industrial culture. But these gross interpretations have proven time and time again to be unreliable. Instead, the detailed, microscopic analysis of tool wear would seem to offer the best reliable basis for tool use inferences. The microscopic equipment asked for in this request is indispensable in order to engage in this research.

References Cited:

MacDonald, George F. and David Sanger

1968 Some aspects of microscope analysis and photomicrography of lithic artifacts. American Antiquity, Vol. 33, No. 2, pp. 237-240.

Semenov, S.A.

1964 Prehistoric technology: an experimental study of the oldest tools and artifacts from traces of manufacture and wear. Cory, Adams, and Mackay, London.

Sokal, Robert R.

1966 Numerical taxonomy. Scientific American. pp. 106-116.

Ce2.4/102.7

VITA

I. VITAL STATISTICS

NAME: Frank W. Eddy

AGE: 40 years

MARITAL STATUS: Married, wife and small son

MILITARY SERVICE: Army, 1952-1954

II. HIGHER EDUCATION:

BA degree - University of New Mexico in 1952, major in  
Archaeology/Anthropology, minor in Geology

MA degree - University of Arizona in 1958, major in  
Archaeology/Anthropology, minor in Geochronology

PhD degree - University of Colorado in 1968, major in  
Archaeology/Anthropology

III. ARCHAEOLOGICAL FIELD TRAINING:

Summer field session of the University of Arizona at Point of Pines,  
Arizona, 1955.

Summer field session of the Southern Illinois University at  
Durango, Mexico, 1956.

IV. PROFESSIONAL EXPERIENCE:

Archaeological laborer for the National Park Service excavating  
in colonial archaeology at Yorktown and Jamestown, Virginia, 1954-55.

Survey crew member on the Glen Canyon Archaeological Project,  
University of Utah, Fall of 1958.

Dig foreman on the Painted Rocks Archaeological Project, University  
of Arizona, winter of 1958-59.

Curator at Museum of New Mexico, researcher and director of the  
Navajo Reservoir Salvage Archaeology Project, 1958-1965.

Crew Member of the Joint Nubian Geological and Archaeological Project  
in the Aswan Reservoir, Egypt, winter of 1963-64.

Research Assistant at University of Colorado Museum, Dig foreman  
at Yellow Jacket and Jurgens Site excavations, 1965-68.



Director of Texas Archaeological Salvage Project, University of Texas, Austin, 1968 - December, 1970.

Assistant Professor, Department of Anthropology, University of Colorado, January 1970 to present. Archaeologist in charge of Chimney Rock Project, University of Colorado Research Center at Mesa Verde.

V. HONORARY SOCIETIES:

Society for American Archaeology, 1953-present

Society for the Sigma Xi, 1965-present.

VI. PUBLICATIONS:

Eddy, F.W.

1958 A Sequence of Cultural and Alluvial Deposits in the Cienega Creek Basin, Southeastern Arizona. Master of Arts Thesis, University of Arizona, Tucson. (unpublished)

Dittert, A.E., Jr., J.J. Hester, and F.W. Eddy

1961 An Archaeological Survey of the Navajo Reservoir District of Northwestern New Mexico. Monograph of the School of American Research and the Museum of New Mexico, No. 23, Santa Fe.

Eddy, F.W.

1961 Excavations at Los Pinos Phase Sites in the Navajo Reservoir District. Museum of New Mexico Papers in Anthropology, No. 4, Santa Fe.

Eddy, F.W.

1963 Excavations at the Candelaria Site, LA 4406. Chapter II in Pueblo Period Sites in the Piedra River Section, Navajo Reservoir District, assembled by A.E. Dittert, Jr. and F.W. Eddy, Museum of New Mexico Papers in Anthropology, No. 10, Santa Fe.

Eddy, F.W.

1963 Cultural Considerations in the Study of Prehistoric Animals. Appendix A in Vertebrate Remains and Past Environmental Reconstruction in the Navajo Reservoir District, by Arthur H. Harris, Museum of New Mexico Papers in Anthropology, No. 11, Santa Fe.

Dittert, A.E., Jr., F.W. Eddy, and B. Dickey

1963 Evidences of Early Ceramic Phases in the Navajo Reservoir District. El Palacio, Vol. 70, No's 1-2, pp. 5-12, Santa Fe.

Schoenwetter, J. and F.W. Eddy

1964 Alluvial and Palynological Reconstructions of Environments, Navajo Reservoir District. Museum of New Mexico Papers in Anthropology, No. 13, Santa Fe.

CE.2.4.1079

Eddy, F.W. and H.E. Dregne

1964 Soil Tests on Alluvial and Archaeological Deposits, Navajo Reservoir District. El Palacio, winter issue, pp. 5-21, Santa Fe.

Eddy, F.W.

1966 Prehistory of the Navajo Reservoir District, Northwestern New Mexico. Museum of New Mexico Papers in Anthropology, No. 15, Parts I and II, Santa Fe.

1968 Culture Ecology and the Prehistory of the Navajo Reservoir District. Doctor of Philosophy Dissertation, University of Colorado, Boulder. (unpublished)

CE. 2.4.107.10

CU Proposal No. 71.5.82  
2/71

BUDGET

Zeiss Stereomicroscope IV

<u>Equipment Description</u>	<u>Price*</u>
Stereomicroscope body with detachable inclined binocular body and pancratic objective system (Zoom)	\$ 917
Objective f=100mm	75
2 eyepieces 10X (\$35 each)	70
2 eyecups (\$2 each)	4
Plastic dust cover	3
Simple analyzer for Stereo-Microscope	66
Filter polarizer 32mm	43
Filter holder	24
Heat absorption filter KG I	10
2 low voltage illuminators, complete (\$150 each)	300
Special stand which can be used in conjunction with the intermediate piece with rack and pinion	124
Small column stand C	198
Eyepiece 25X	45
Focusing eyepiece 25X	77
Attachment objective 2X for Stereo Mixroscope IV	93
Phototube on slider	<u>191</u>
Sub-total	\$2,240

(All of the above available from Van Waters and Rogers.)

Bausch & Lomb 35mm Micro/Macro System for Technical Photography

Camera body (Canon FT)  
Right angle viewer  
Mount converter A  
Light-tight connector  
Adjustable bellows  
Stanchion  
Arm  
Lock collar

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CU Proposal No. 71.5.82  
Budget Cont'd

Base board	\$ 531
Locking Cable Release (Kit No. 42-76-02-22 Chrome trim camera body)	
Camera body cradle	14
Light meter amplifier	<u>60</u>
Sub-total	\$ 605
TOTAL	\$2,845

\*Price as of Jan. 1, 1971.

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Explanation of budgetary items:

This request is for a Zeiss Stereomicroscope IV, accessories, and a Canon FT camera attachment. The latter will be employed in a combination of jobs including photomicrography (greater than 20X), photomacrography (photographic reproductions between 1X and 20X without the use of the microscope), and for field research. The funds requested are to be a supplement to those already in hand obtained through a contract from the United States Forest Service which covers (1) personnel assistance, (2) expendable supplies, and (3) costs of report preparation and printing but not capital outlay for equipment such as the microscope-camera outfit.

The basic Zeiss microscope has a low range of magnifications (8X to 40X) such as that employed by the Russian prehistorian S.A. Semenov. I am asking for lens attachments (both objective and ocular) which will increase the power of the scope to 200 magnifications, allowing inspection in the range of the work reported by MacDonald and Sanger.

In addition, two light sources are requested for polarized illumination of the opaque and translucent specimens in reflected light. The low voltage illuminators will have a filter holder attachment suitable for mounting both a polarizing filter as well as a heat absorption filter necessary to reduce glare in viewing and photography. A simple analyzer for polarized light attaches to the objective end of the microscope.

The Canon FT camera and accessories form a kit suitable for both micro and macro technical photography essential for recording the manufacture and wear characteristics observed on the prehistoric tools. Through the photographic document, I hope to pursue the work of Semenov, which deals with the kinematics (motions involved in tool use) of working with the hand and the formation of striations on tools (1964:16-21).

Photomicrographic work does not require a camera lens; the microscope optics substitute for this purpose. However, I have requested a lens to allow year-round use of the equipment; the camera with its own lens can profitably be employed in the field during the summer excavation season.

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