

GREAT BASIN PALEOENVIRONMENTAL STUDIES PROJECT
TECHNICAL PROGRESS REPORT
FIRST QUARTER
(January - August, 1993)

DESERT RESEARCH INSTITUTE
Cooperative Agreement Number DE-FC08-93NV11417

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submitted to
U.S. Department of Energy
Yucca Mountain Site Characterization
Project Office
Las Vegas, Nevada

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PALEOBOTANICAL STUDY
Dr. Peter E. Wigand, Principal Investigator

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Project Goal:

The goals of the Paleobotanical studies are to 1) reconstruct the response of vegetation at the community and the organismal levels to climate in order to identify periods of mesic climate at Yucca Mountain and the adjacent region during the last 20,000 to 50,000 years. This is being achieved by integrating data obtained from nearly continuous sediment records of pollen (and the stable isotope analyses obtained from the pollen), and 2) plant macrofossils, pollen and stable isotopes from fossil woodrat middens. These data will be used to identify periods of much more mesic climate, and provide information that can be used to estimate the magnitudes and durations of rainfall shifts by reference to modern distribution, characteristics and ecophysiology of analogous plant communities and/or indicator species. Of particular importance is determination of the amounts, and actual period of availability of excess water during these periods. These estimates, in combination with those derived from ostracode and diatom analyses conducted by the USGS will provide reasonable indications of variations in climate that can be used to reconstruct past extremes in infiltration rates that may serve as estimates of those that may be expected during the next 10,000 years at Yucca Mountain.

Project Tasks:

Palynological:

1. Extend the present 4,000 year long vegetation history record from Lower Pahranaagat Lake, southern Nevada.
The present 4,000 year long vegetation history record from Lower Pahranaagat Lake, southern Nevada has been sampled more intensively for pollen and radiocarbon dates to add detail and precision to the present record and resolve rates of climate change and vegetation response.
2. Assembly of a modern plant community pollen data base.
The data base has been assembled and input will continue throughout the project.
3. Assembly of available palynological data from the Intermountain West into a data base, including the augmentation of the data from some of the localities previously examined by us in order to accomplish the goals of the project. This includes the submission of radiocarbon dates and tephra analyses for the resolution of chronologies, and analyses of pollen samples taken at closer intervals to resolve the rates of climate change, their magnitude and the response of the vegetation community.
Assembly of a data base is proceeding. In addition, we are putting the data into a format conforming with the guidelines followed by the National Geophysical Data Center.

Paleobotanical (Continued)

4. Coring of selected southern Nevada localities for paleoenvironmental records.
The requisite state-wide and local permits have been obtained from the BLM and Fish and Wildlife Service for the coring of selected southern Nevada localities for paleoenvironmental records. Three localities including Pahrump Playa, Stewart Playa and Peter's Playa have already been cored.

Paleonidological:

5. Assembly of available woodrat midden data from the Intermountain West into a data base.
The data base has been assembled and input will continue throughout the project.
6. Process samples already collected that are pertinent to the goals of the project.
Samples previously collected from the Pahranaagat Range of southern Nevada have been processed, some radiocarbon dates have been run and the plant materials are being sorted and identified. Stable isotopic samples will be run in the near future. Insect remains will be sent to a subcontractor for identification and analyses.
7. Collection of modern vegetation and climate data pertinent to interpretation of woodrat midden data in an analogue/nonanalogue manner.
Collection is on going.
8. Select, collect and process new midden localities that are pertinent to the goals of the project.
New localities in southern and central Nevada have been selected, collected and are being processed, radiocarbon dated and analyzed. These localities are adjacent to localities that are being or have been cored for pollen and ostracode records.

Problems Encountered:

We are currently waiting upon the resolution of an application made to the Air Force to core at several sites in southern Nevada.

PALEOFAUNAS

Dr. Stephanie Livingston, Principal Investigator

Project Goal:

The goal of this study is to construct a history of Great Basin vertebrates, particularly mammals, that will provide empirical evidence of past environmental and climatic conditions within the Great Basin as it is recorded by the animals. Taxonomic composition of archaeological and paleontological faunas from various areas within the Great Basin and morphological change within individual mammalian taxa at specific localities are being investigated to monitor faunal response to changing environmental conditions. Data are being obtained from published records, modern museum specimens, and raptor pellets to provide a modern control to which the paleofaunal data can be compared. This study will provide an independent set of surrogate data for use in building a model of past conditions and assessing the effects of past climate change on various aspects of the environment.

Progress on Tasks:

1. Data collection from existing paleo- and modern- vertebrate collections.
Data collection from two archaeological sites, Floating Island Cave and Pintwater Cave, which have been excavated independently from this project, is in progress.
2. Field recovery of modern, archaeological, and/or paleontological vertebrate materials.
Field work was conducted at two rockshelters in the Pahrump Valley and the DeLong Mammoth Locality. A survey of Pahrump and the Las Vegas Valleys for vertebrate localities was conducted.
3. Dating and other special analyses.
Processing and data collection from modern materials is in progress.

Problems Encountered:

No specific problems have been encountered.

GEOMORPHOLOGY

Dr. Nicholas Lancaster, Principal Investigator

Project Goal:

The objective of the geomorphology component of the paleoenvironmental program is to document the responses of surficial processes and landforms to the climatic changes documented by studies of packrat middens, pollen, and faunal distributions. This major objective will be achieved by a variety of projects designed to reveal the linkage between climate change and physical response. The project will focus on: 1) stratigraphic relationships between lake deposits and aeolian or fluvial sediments and landforms; 2) cut and fill sequences in floodplain and river-channel deposits; 3) identification of periods of dune mobility and stability; 4) documentation of episodes of alluvial fan and terrace development and erosion; and 5) correlation of (3) and (4) to climatically driven lake-level fluctuation as revealed by shoreline features such as strandlines and beach ridges. Numerical and relative dating of geomorphic events will be accomplished by a range of techniques including C^{14} , tephrochronology, dendrochronology, luminescence, and soil chronology.

Progress on Tasks:

1. Work in progress has concentrated on stratigraphic relationships between lake deposits and aeolian and fluvial sediments and landforms to provide the basis for regional models of the response of surficial processes and landforms to climatic change. This has involved documentation of episodes of alluvial fan and river terrace development and erosion; and correlation of these to climatically driven lake-level fluctuations as revealed by shoreline features such as strandlines and beach ridges.
2. We have examined stratigraphic relationships of late Quaternary alluvial, lacustrine, aeolian, and alluvial fan deposits in a number of areas of northern and western Nevada. These studies have been focused primarily on late Pleistocene/Holocene deposits in and adjacent to the Lake Lahontan Basin, with additional field studies in southwestern Nevada. Samples of volcanic ashes and/or materials suitable for radiocarbon dating (e.g. gastropods) have been collected from a number of areas to establish temporal control.
3. Studies of the relationships between alluvial fan deposits and Lake Lahontan beach ridges in Buena Vista Valley have been conducted to determine the controls on fan morphology and the age of the depositional events of the fan in order to compare these ages with the level of the paleo-Lake Lahontan during the times of fan development. The goal is to understand climatic controls on the fan deposition. This study will also aid in the construction of a regional model for alluvial fan development in northern Nevada.

Geomorphology (Continued)

Problems Encountered:

Dendroclimatic studies with the aim of understanding relationships between changes in climate and Holocene periods of erosion and sedimentation in river valleys (cut and fill sequences) in southern and central Nevada have been delayed by the untimely death of Dr. Don Graybill, who was acting as a subcontractor to the project for dendroclimatic analyses. Initial palaeoclimatic reconstructions of temperature and precipitation are, however, available from the White Mountains, California (8,600 years) and the White Pine Mountains, central Nevada (5,200 years), with shorter records (1,000 - 2,000 years) from five other areas of the Great Basin.

TRANSPORTATION

Dr. Richard French, Principal Investigator

Project Goal:

The goal of this study is to compare the results from three models (FESWMS-2DH, DAMBRK, and FLO-2D) that have been suggested as appropriate for evaluating flood flows on alluvial fans with the results obtained from the traditional one-dimensional, stochastic model used in previous research performed by DRI for the Yucca Mountain Project. In a previous research project, three alluvial fans with rail transportation alignments crossing them were identified, hydrologic data were collected, flood hazard/drainage analyses were performed using the one-dimensional stochastic model, and the results of the flood hazard/drainage analyses were compared with the documented historic performance of the drainage system. Therefore, the basis for this comparison of model results will be these three alluvial fans.

Progress on Tasks:

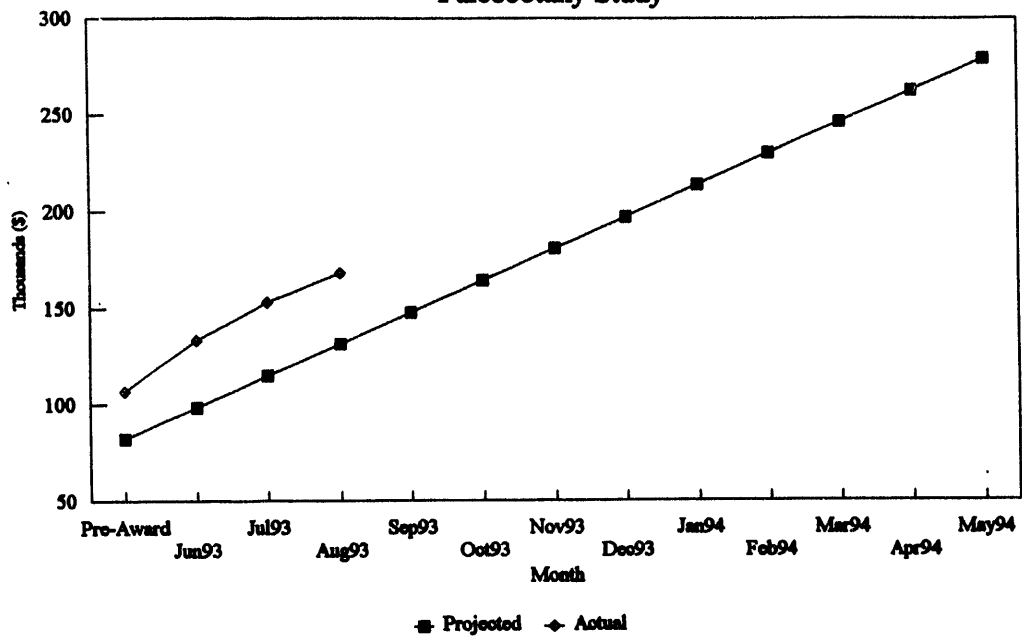
1. An appropriate graduate student in the UNLV Water Resources Management Program was identified. A thesis committee was formed, and a thesis proposal based on this project was accepted by the committee, the program, and the Graduate School.
2. The models, FESWMS-2DH and DAMBRK, have been acquired and tested. An agreement has been reached with Dr. O'Brien to use his proprietary model, FLO-2D, for a minimal fee. It has also been agreed not to use the model commercially.
3. All data files and material regarding the three alluvial fans on which the model are to be tested have been recovered.
4. Peer-Reviewed Publication Activity:
French, R.H., Fuller, J.E., and Waters, S., 1993. "Alluvial Fan: Proposed New Process-Oriented Definitions for Arid Southwest." ASCE, *Journal of Water Resources Planning and Management*, Vol. 119, No. 5, pp. 588-598.

Flippin, S.J. and French, R.H., 1993. "Comparison Results from an Alluvial Fan Design Methodology with Historic Data." ASCE, *Journal of Irrigation and Drainage Engineering*, Accepted.

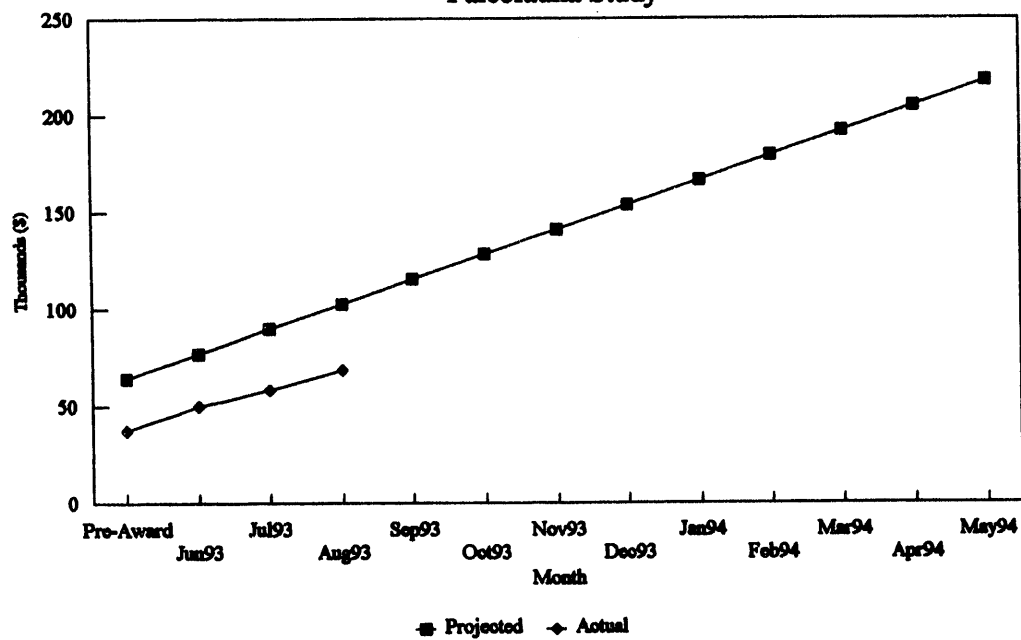
Problems Encountered:

Sufficient funding is not currently available to meet the project tasks contained in the proposal. A request for additional funding was submitted to DOE in September, 1993.

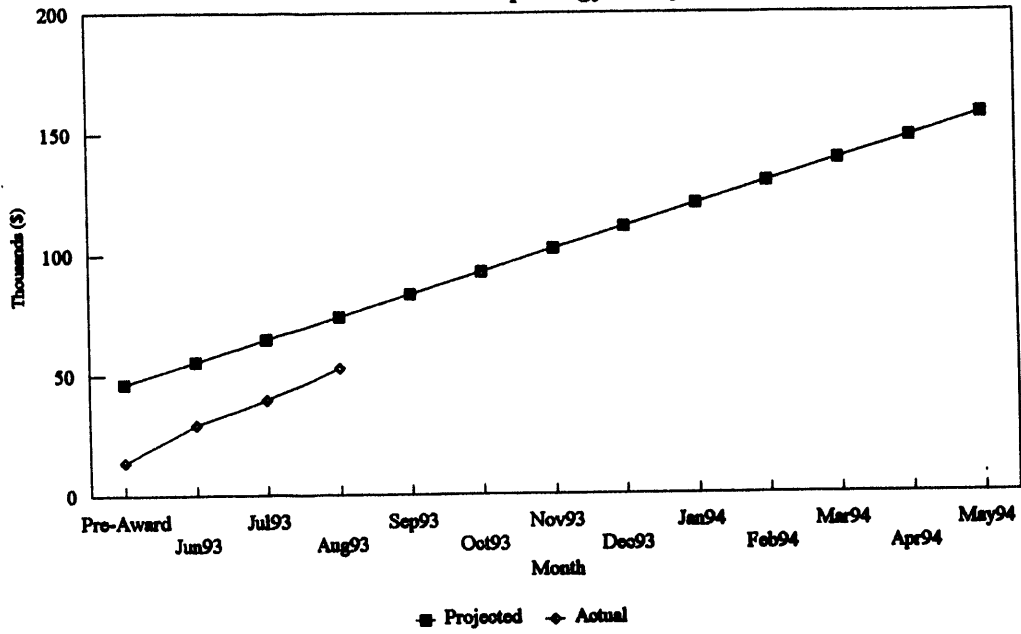
FY 1993 Budget Summary Paleobotany Study



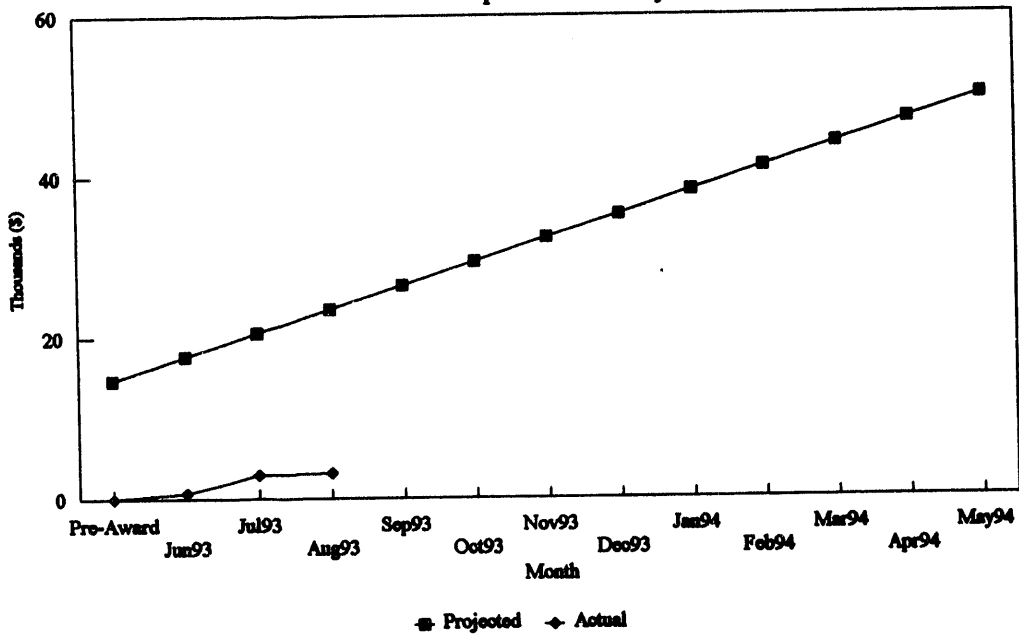
FY 1993 Budget Summary Paleofauna Study



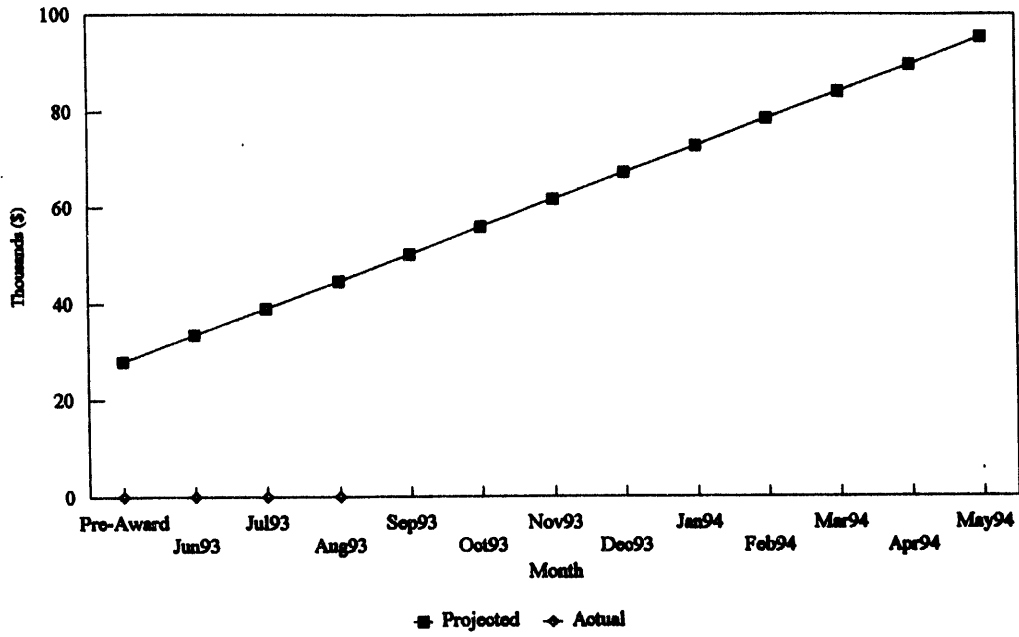
**FY 1993 Budget Summary
Geomorphology Study**



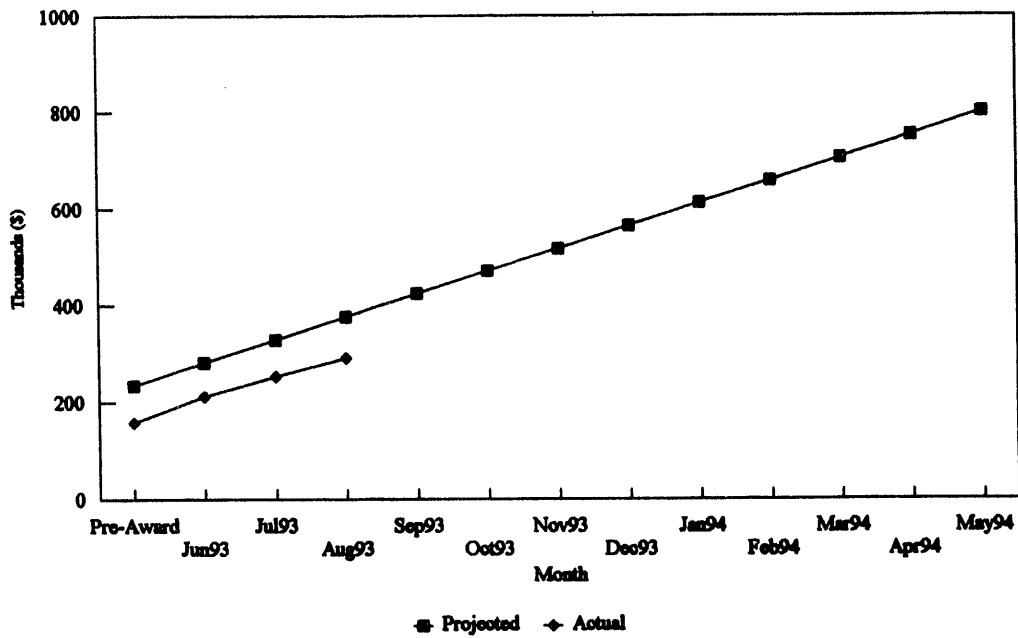
**FY 1993 Budget Summary
Transportation Study**



FY 1993 Budget Summary Subcontracts



FY 1993 Budget Summary All Tasks



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