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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
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Study Plan for
Study 8.3.1.5.1.3

Climatic Interpretations of Terrestrial Paleoecology

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Washington, DC 20585

Prepared by
U.S. Geological Survey

YMP-021-R1
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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
STUDY PLAN APPROVAL FORM

Study Plan Number 8.3.1.5.1.3

Study Plan Title Climatic Interpretations of Terrestrial Paleoecology

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same midden are submitted for radiocarbon dating. The paleobotanical data from the individual midden assemblages are compiled to create time series of vegetational change from a given area and vegetational setting. Replication of pack rat chronologies from sites with similar settings ensures that site-specific phenomena do not introduce bias into the interpretation of the data set.

In addition to plant macrofossils, pack rat middens are rich sources of vertebrate and insect remains, pollen, and cellulose for isotopic investigations ($\delta^{18}O$, $\delta^{13}C$, δD). The data may be analyzed to elucidate certain paleoclimatic signals, such as the past seasonal distribution of precipitation or the annual range of temperatures (see, e.g., Long, et al, 1990 and Epstein, et al, 1977).

3.1.3 QA level assignment

Quality Assurance (QA) requirements for this activity will be specified in a Yucca Mountain Project QA Grading Report, which will be issued as a separate document. All procedures applicable to this activity will be identified on the basis of the findings in the Grading Report and will be prepared in accordance with applicable QA requirements.

3.1.4 Required tolerances, accuracy, and precision

No explicit requirements for tolerance, accuracy, or precision have been specified for this activity. Radiocarbon analysis provides an estimate of the age of the midden assemblage, accurate to within a few hundred years for materials as old as 40,000 years (Colman and Pierce, in press). Where more precision is required, multiple samples from the same midden are submitted for dating. Plant remains from midden macrofossil assemblages should be identified to the species level, if possible.

3.1.5 Range of expected results

From previous studies (e.g., Betancourt, et al, 1990), it is expected that the vegetation in the southern Great Basin over the past 40,000 years has included desert, steppe, woodland, and subalpine forest assemblages. Few data are available to indicate what the longer term variations have been or what the conditions were during previous much-warmer-than-present episodes (Smith, 1974).

3.1.6 Equipment

This activity uses standard field and laboratory equipment (Donahue, et al, 1983; Linick, et al, 1986). Field reconnaissance and sampling equipment includes rock hammers, chisels, flashlights, sample bags, sample labels, marking pens and tape, field notebooks, maps, compasses, and cameras. Laboratory equipment includes notebook, plastic buckets, soil-sieves, drying oven, triple-beam balance, tweezers, and a dissecting microscope. A microcomputer and database program are used to organize the data.

sediment) or relative percentages. The stratigraphic plots are interpreted in terms of increasing or decreasing amounts of plant taxa responsible for the various pollen types, taking into account the relative pollen production of individual plant groups, the ease by which pollen is distributed, and the processes by which it is incorporated into the sediment and preserved. Methods and techniques for radiocarbon dating are discussed by Donahue, et al (1983) and Linick, et al (1986). Other methods for dating Quaternary materials are given by Colman and Pierce (1991).

In some cases pollen studies will be conducted at the same sites as those for paleolacustrine investigations (Study 8.3.1.5.1.2), because lake sediments may contain well-preserved pollen and represent more or less continuous deposition. However, because of exposure and oxidation, playa deposits may be unsuitable for pollen analysis. Pack rat middens also contain pollen, particularly from the local vegetation surrounding the midden site, and its analysis can be helpful in determining the nature of the pollen rain (the pollen coming from and falling on any region) in areas where lakes and marshes are few.

3.2.3 QA level assignment

Quality Assurance (QA) requirements for this activity will be specified in a Yucca Mountain Project QA Grading Report which will be issued as a separate document. All procedures applicable to this activity will be identified on the basis of the findings in the Grading Report and will be prepared in accordance with applicable QA requirements.

3.2.4 Required tolerances, accuracy, and precision

No explicit requirements for tolerance, accuracy, or precision have been specified in the SCP for this activity. Radiocarbon analyses (conventional or AMS) provide an estimate of the ages of pack rat middens accurate to within a few hundred to a few thousand years. Pollen stratigraphic profiles are dated with radiometric techniques (radiocarbon, U series, K/Ar, Ar/Ar, or others as appropriate) through tephrochronology, paleomagnetics, fossil correlation, or other techniques as appropriate, with the accuracy being dependent on the method (see Colman and Pierce, in press).

3.2.5 Range of expected results

The discussion in section 3.1.5 is applicable to this section when sediment accumulations is rapid. If sediment accumulation is low (centuries or millennia) pollen grains are often not preserved. If they are preserved, their value for paleoclimatic interpretations are greatly diminished.

3.2.6 Equipment

Items of equipment required for radiometric dating are given in Donahue, et al (1983) and Linick, et al (1986). Items utilized for field work for this activity are: coring devices,

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