

INFORMATION COPY

SAMPLE COLLECTION PROCEDURE FOR ROCK VARNISH STUDIES

Effective Date 2/27/90

*Charles D. Harrington*

C. D. Harrington  
Preparer

Jan. 22, 1990  
Date

*Dave Vaniman*

D. T. Vaniman  
Reviewer

Jan. 22, 1990  
Date

*H. P. Nunes*

H. P. Nunes  
Quality Assurance Project Leader

Jan 24 1990  
Date

*R. J. Herbst*

R. J. Herbst  
Technical Project Officer

13 Feb. 1990  
Date

INFORMATION COPY

SAMPLE COLLECTION PROCEDURE FOR ROCK VARNISH STUDIES

1.0 PURPOSE

This procedure describes the methods to be used in the collection of rock varnish samples from geomorphic surfaces and deposits, on Yucca Mountain, on and near the Nevada Test Site, or other selected localities within the southern Great Basin. Rock varnish data are utilized for four types of geologic determinations. These are: (1) obtaining chronometric ages of geologic surfaces or deposits; (2) obtaining additional calibration points for the Yucca Mountain rock varnish dating curve; (3) the study of rock varnish development through time on stable geomorphic surfaces; and, (4) studying rock varnish chemistry. Selection of sampling locations, sample collection and identification, and documentation are described.

2.0 SCOPE

This procedure applies to all rock varnish samples taken for the YMP project. Data acquired from the analysis of samples obtained using this procedure will be used in site characterization and the activity is therefore Quality Level 1.

3.0 PRINCIPLES

Rock varnish coatings on cobbles from geomorphic surfaces and from exposed deposits in arid environments can be used to date these surfaces or deposits over an age range of several thousand to more than a million years. The ratio of mobile to immobile cations  $[(K + Ca)/Ti]$  has been found to decrease with time and provide a relative-age indicator for rock varnish from a given region. Calibration curves, constructed by determining varnish cation ratios (VCRs) on surfaces previously dated by isotopic techniques are used for the calibrated time interval to estimate the VCR age of unknown-age deposits within the region. Because of variations in climate, rates of dust deposition, and differences in dust chemistry a separate VCR curve is created for each specific region of study. VCRs are determined by SEM chemical analyses of varnish on disks (about 2.5 cm in diameter) cored from rock varnish samples. The VCR for each geomorphic surface or deposit to be dated is the average of the VCRs determined for the varnish on each sampled cobble.

Varnish characteristics and chemistry vary both across an individual rock surface and among a group of rocks taken from a single geomorphic surface. Therefore, collection of duplicate samples having identical chemistry is not possible. The SEM technique of rock varnish dating, however, analyzes *in situ* varnish on rock substrates. All collected rock samples and all varnish cores cut from rock samples are neither modified nor destroyed during analysis. All rock specimens and disks made from varnish cores are retained at Los Alamos, and thus are available for verification and reanalysis. All rock material collected during rock varnish studies and all disks made from these rock varnish samples will be archived in the YMP Sample Management Facility at NTS following the completion of YMP rock varnish studies.

## 4.0 PROCEDURE

INFORMATION COPY

### 4.1 Site selection and identification

Sample sites are located on rock outcrops, on desert pavements formed on geomorphic surfaces, or on other stabilized geomorphic deposits. The type of rock varnish samples collected as well as the characteristics of the sampling site are determined by the nature of the geologic problem being studied. The location of the sampling site will be recorded on an appropriate topographic, geologic, highway, or other map. The site location and description will be recorded in the collector's controlled field notebook. Photograph(s) of the site may also be taken and these will be labeled and dated and retained with the collector's controlled notebook.

### 4.2 Sample collection and identification

Rock varnish samples are selected at the site by qualified Los Alamos or U.S. Geological Survey staff geologists. Samples of rock varnish are either collected as whole varnish coated surface clasts or as chips of varnished rock broken from surface clasts or outcrops of rock. The number of samples acquired for a surface depends on the degree of complexity of the surface but generally equals or exceeds eight. Samples are not collected in close proximity to lichens and other vegetation; to varnish formed along cracks; or rock surfaces in contact with soil. Wind-abraded and spalled rock surfaces are also avoided. Photographs may be taken to show the character of the surface from which the samples are taken and that portion of the surface from which samples are collected. Rationale for sample collection is recorded in the investigator's notebook. Samples selected are those possessing the most mature varnish development on the geomorphic surface to be sampled. Each sample will be labeled with a sample identification number. Sample identification will be sufficient to trace a sample to its original field location and collector. Sample identification for one sample collected from each surface or deposit will include the collector's initials and a sequence number, in addition to a lab identification number, unique to that collector's YMP field notebook. For all additional samples collected from the same surface or deposit, the sample identification number will consist of the unique sequential lab identification number. The sample will be marked by a permanent marking pen either on the sample itself, or on tape wrapping the sample, or on the sample bag. The sample numbers, the underlying substrate, and a field description of the surface from which the samples are collected are recorded in the field notebook. Notations may be made on photographs taken of sampled surfaces.

### 4.3 Sample shipment

Rock varnish samples shall be packed for shipment to Los Alamos in a manner so as to preclude destruction of the varnished rock surface during transport. Each varnished clast will be individually wrapped in paper or other protective material and placed in a sample bag on which sample identification numbers will be marked by a permanent marking pen. Sample bags containing rock varnish samples will be hand carried to Los Alamos whenever possible. If sample bags containing rock varnish samples are shipped to Los Alamos, they shall be packed in heavy cardboard shipping containers sturdy enough to preclude crushing of samples during transport.

Rock varnish samples hand-carried to Los Alamos shall be recorded in the sample receiving/tracking logbook. Rock varnish samples shipped to Los Alamos from Mercury/NTS or from another locality shall be handled in accordance with the Procedure for Identification and

**Control of Samples (TWS-QAS-QP-08.1, R1).** Upon receipt, a copy of the shipping manifest or a memo verifying receipt shall be put in the EES-1 resident file along with a list of samples. Each shipment entry in the sample tracking logbook will be signed and dated by the recipient.

#### **4.4 Acceptance/Rejection Criteria**

If rock varnish samples are collected following the procedure described in Sections 4.1 - 4.3, the samples will be acceptable for preparation for rock varnish analysis.

### **5.0 QUALITY ASSURANCE**

#### **5.1 Personnel**

This rock varnish sampling procedure shall be performed by qualified personnel with a geoscience degree or who can demonstrate an equivalent combination of education and experience. Evidence of qualification shall be documented according to the LANL Personnel Certification Procedure.

#### **5.2 Calibration**

Not applicable.

### **6.0 RECORDS**

**6.1 Documentation and traceability of samples are addressed in Sections 4.1 and 4.2.**

**6.2 Records will be controlled in accordance with the LANL YMP Records Control Procedure.**

TWS-ESS-DP-114, R1

INFORMATION COPY

SAMPLE COLLECTION PROCEDURE FOR ROCK VARNISH STUDIES

Effective Date 6-5-90

Charles D. Harrington  
Preparer  
C. D. Harrington

April 23, 1990  
Date

D. Vaniman  
Technical Reviewer  
D. Vaniman

April 24, 1990  
Date

Stephen Bolivar  
QA Reviewer  
S. L. Bolivar

4/24/90  
Date

Charles D. Harrington  
Principal Investigator  
C. D. Harrington

4/24/90  
Date

H. P. Nunes  
Quality Assurance Project Leader  
H. P. Nunes

5/3/90  
Date

R. J. Herbst  
Technical Project Officer  
R. J. Herbst

6/5/90  
Date

LOS ALAMOS NATIONAL LABORATORY  
YUCCA MOUNTAIN PROJECT  
CHANGE REQUEST

CHANGE REQUEST No. 144  
DATE 3/28/90

INFORMATION COPY

PROCEDURE No. TWS-ESS-DP-114, R1 Sample Collection Procedure for Rock Varnish Studies

CHANGE REQUESTED:

A. Insert after first sentence in Section 4.2:

"A geoscientist will be qualified to perform this field procedure only after training in rock varnish sample collection and field techniques by the PI or by another qualified geoscientist designated by the PI."

B. Rename Section 4.3 as "Sample Handling, Shipping and Storage."

C. Add signature lines for the Principal Investigator and QA reviewer on the cover page. (An amended cover page is included as Attachment 1.)

REASON FOR CHANGE:

A and B. For clarification.

C. As required in QP 5.2, CR 088.

These changes should be considered minor since they do not change how the procedure is implemented.

CHANGE REQUESTED BY Charles J. Harrington DATE 4/23/90  
REVIEWED BY Stephen J. Bolan DATE 4/24/90  
QAPL APPROVAL HPA [Signature] DATE 5/3/90  
TPO APPROVAL R. J. [Signature] DATE 6/5/90  
EFFECTIVE DATE June 5, 1990