Identifier:	Revision:	Effective Date:	Review Date:
SOP-09.11	**0**	**04/11/01**	**12/16/2003**

ER Document Catalog Number: **ER2001-0149**

Author: David Vaniman

environmental restoration project

A Department of Energy Environmental Cleanup Program

Environmental Restoration Project
Standard Operating Procedure

for:

Petrography

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545

Revision Log

Revision No.	*Effective Date*	*Prepared By*	*Description of Changes*	*Affected Pages*
R0	04/11/01	David Vaniman	Reassignment of Petrography procedure from section 3 to section 9, with update to describe current methods and to reformat	All
Review	12/16/2003	Mark Thacker	Deemed process adequate.	All

Petrography

Table of Contents

Petrography

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods used to obtain petrographic data for the Los Alamos National Laboratory (Laboratory) ER Project.

2.0 SCOPE

This SOP is a manadatory document and shall be implemented by all ER Project participants when performing petrographic analyses for the ER Project

3.0 TRAINING

3.1 All users of this SOP are trained by reading the procedure. The **users** shall ensure the training is documented in accordance with QP-2.2, and is entered appropriately in the ER Project Training Database located at http://erinternal.lanl.gov/Training/Training.asp.

3.2 The **Geology Task Leader** will monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments in accordance with QP-2.2.

Completion of at least one college-level course in petrography and a minimum of a BS in Geology, Earth Sciences or equivalent are required to use this procedure.

4.0 DEFINITIONS

4.1 *Petrography*—petrography is the branch of geology that deals with the description and classification of rocks, particularly by means of microscopic examination of thin sections.

5.0 BACKGROUND AND PRECAUTIONS

5.1 The principles of petrographic analysis are learned through college-level courses. A standard reference for petrography is Williams et al. (1954). Mineral identification and description can be augmented by use of other texts such as Wahlstrom (1955) and Tomkeieff (1983).

5.2 The only significant source of uncertainty and error in petrographic description is mineral and textual misidentification. Analysts are advised to refrain from making optical mineral identifications where the minerals are too fine-grained for an adequate analysis or where the topical properties are

ambiguous. Where mineral identifications must be ventured without certain optical identity, the entry should be marked as "possible," "?," or otherwise queried.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 Geology Task Leader

6.2 Quality Program Project Leader

6.3 ER Project Participants

6.4 Users

7.0 EQUIPMENT

7.1 Petrographic descriptions may be obtained by unaided visual observations, by hand lens, by binocular microscope, or by petrographic microscope. Any brand or model of lens, binocular, or petrographic microscope may be used for petrographic analysis.

8.0 PROCEDURE

Note: Subcontractors performing work under the ER Project's quality program may follow this standard operating procedure (SOP) for petrography or may use their own procedure(s) as long as the substitute meets the requirements prescribed by the ER Project Quality Management Plan, and is approved by the ER Project's Quality Program Project Leader (QPPL) before the commencement of the activitie(s).

Note: ER Project personnel may produce paper copies of this procedure printed from the controlled-document electronic file located at http://erinternal.lanl.gov/home_links/Library_proc.htm. However, it is their responsibility to ensure that they are trained to and utilizing the current version of this procedure. The author may be contacted if text is unclear.

Note: Deviations from SOPs are made in accordance with QP-4.2, Standard Operating Procedure Development and documented in accordance with QP-5.7, Notebook Documentation for Environmental Restoration Techncial Activities.

8.1 Petrographic descriptions are either descriptive or quantitative. No two analysts will generate identical descriptions. For petrographic descriptions, the recorded information will be traceable to a specific location in the field or to a specific sample in the laboratory to allow other petrographers to review the description. Photographs and drawings, appropriately keyed to specific

field locations or samples, may be used to support petrographic descriptions. Quantitative petrographic analysis includes, but is not limited to, point counting and size measurement. The limitations and applications of point counting are described in references such as Howarth (1998). Coarse features may be measured by any standard scale, with metric units preferred; microscopic features may be measured by ocular scale. These scales are used for approximate and relative size classification only; thus calibration of the scales is not required. Examples of petrographic descriptions appropriate to this procedure can be found in the figure captions of Williams et al. (1954). Standard references for petrographic terms include Bates and Jackson (1980), Tomkeieff (1983), and Wahlstrom (1955). Many of the terms used for textural features of silicic volcanic rocks are described in Ross and Smith (1961) and Smith (1960).

8.2 Petrographic analyses are considered acceptable as descriptive data. Rejections of certain parts of a petrographic analysis may be made by the same analyst or by another analyst reanalyzing of the same sample; in such a case, the cause for the rejection should be described in the reanalysis and referred back to the original analysis. Because a wide latitude is possible in descriptive parameters, such rejections should be rare. The likeliest cause of a rejection is mineral misidentification based on optical properties; where mineral identity is optically ambiguous and important to the sample description. Confirmation of mineral identity should be sought through analysis by microprobe, LANL-ER-SOP-9.02; X-ray diffraction, LANL-ER-SOP-9.03; or scanning electron microscopy, LANL-ER-SOP-9.08.

8.3 Lessons Learned

During the performance of work, **ER Project participants** shall identify, document and submit lessons learned in accordance with QP-3.2, Lessons Learned, located at: http://erinternal.lanl.gov/home_links/Library_proc.htm.

9.0 REFERENCES

ER Project participants may locate the ER Project Quality Management Plan at http://erinternal.lanl.gov/home_links/Library_proc.htm.

The following documents are cited within this procedure.

LANL-ER-SOP-9.02, Operating the Cameca SX-50 Microprobe

LANL-ER-SOP-9.03, Operation of Siemens D-500 X-ray Diffractometers

LANL-ER-SOP-9.08, Operating the ADEM Scanning Electron Microscope

LANL-ER-QP-2.2, Personnel Orientation and Training

LANL-ER- QP-3.2, Lessons Learned

LANL-ER-QP-4.2, Standard Operating Procedures Development

LANL-ER-QP-4.3, Records Management

LANL-ER-QP-5.7, Notebook Documentation for Environmental Restoration Techncial Activities

Bates, R. L. and J. A. Jackson (editors). 1980. Glossary of Geology. American Geological Institute, Washington, D. C.

Howarth, R.J.. 1998. Improved estimators of uncertainty in proportions, point-counting, and pass-fail test results. Amer. Jour. Sci. 298, 594-607.

Smith, R. L. 1960. Zones and zonal variations in welded ash flows. U.S. Geol. Survey Prof. Paper 354-F, p. 149-159.

Tomkeieff, S. I. 1983. Dictionary of Petrology. Wiley, 680p.

Wahlstrom, E. E. 1955. Petrographic Mineralogy. Wiley, 407p.

Williams, H., F. J. Turner, and C. M. Gilbert. 1954. Petrography. W. H. Freeman and Co., San Francisco.

10.0 RECORDS

The u**sers** of this procedure are responsible for submitting the following records (processed in accordance with QP-4.3) to the Records Processing Facility.

10.1 Notebook records of the sample handling and results of analysis relevant to production of petrographic data.

11.0 ATTACHMENTS

None

Using a token card, click here to record "self-study" training to this procedure.

If you do not possess a token card or encounter problems, contact the RRES-ECR training specialist.