PETROGRAPHY PROCEDURE

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PETROGRAPHY PROCEDURE

1.0 PURPOSE

The purposes of this procedure are (1) to standardize the petrographic descriptions used within mineralogy-petrology tasks through use of a set of primary reference books and (2) to assure adequate documentation of petrographic descriptions.

2.0 SCOPE

This procedure may be used for any petrographic descriptions made by standard optical methods (i.e., unaided visual observation, hand lens, binocular microscope, petrographic microscope) for the Yucca Mountain Project.

3.0 APPLICABLE DOCUMENTS AND REFERENCES

Petrographic studies within Work Breakdown Structure (WBS) element 2.3.4.2 (Mineralogy-Petrology) are defined in the Site Characterization Plan (SCP) and its updates. Quality procedures cited below (see section 8.5) are TWS-QAS-QP-03 [Document Control Procedure], TWS-MSTQA-QP-14 [Research and Development (Experimental) Procedure] and TWS-QAS-QP-16.1 [Procedure for Corrective Action]. Detailed technical procedures cited below are TWS-ESS-DP-07 [for electron microprobe analysis], TWS-ESS-DP-16 [for x-ray diffraction analysis], TWS-ESS-DP-101 [for sample tracking], TWS-ESS-DP-102 [for point-counting], and TWS-ESS-DP-112 [for scanning electron microscopy].

Published reference works applicable to this procedure are:

Bates, R.L. and Jackson, J.A. (editors) (1980) Glossary of Geology. American Geological Institute, Washington, D.C., 751 pp.

Ross, C.S. and Smith, R.L. (1961) Ash-flow tuffs: Their origin, geologic relations and identification. U.S. Geol. Survey Prof. Paper 366, 81 pp.

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

Williams, H., Turner, F.J., and Gilbert, C.M. (1954) Petrography. W.H. Freeman and Co., San Francisco, 406 pp.

4.0 RESPONSIBILITIES

The principal investigator (PI) for each subtask within WBS element 2.3.4.2 has the responsibility for organizing and overseeing petrographic studies and recording these in the plan of research in the relevant study plan. The PI is also responsible for insuring that this procedure is implemented. The individual analyst is responsible for recording his petrographic observations in a controlled field or laboratory notebook.

5.0 PRINCIPLES

The principles of petrographic analysis are learned through college-level course work. The standard reference for this procedure is Williams et al. (1954).

6.0 DEFINITIONS

There are no unique definitions in this procedure.

7.0 PROCEDURE

7.1 Adequate and Appropriate Equipment

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 or optical microscope may be used for petrographic analysis.

7.2 Preparatory Verification

No preparatory verification of equipment is necessary. Sample tracking is required and will follow procedure TWS-ESS-DP-101.

7.3 Controlled Environmental Conditions

No control of environment is necessary.

7.4 Data to be Recorded

Petrographic descriptions are either descriptive or quantitative. No two analysts will generate identical descriptions; for such 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. Point counting is described in procedure TWS-ESS-DP-102. 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). The standard reference for petrographic terms will be Bates and Jackson (1980). Many of the terms used for textural features of silicic volcanic rocks are described in Ross and Smith (1961) and Smith (1960).

Petrographic analyses are considered acceptable as descriptive data. Rejection of certain parts of a petrographic analysis may be made by the same analyst or by another analyst based on reanalysis 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. Since 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 electron microprobe analysis (TWS-ESS-DP-07) and/or x-ray diffraction analysis (TWS-ESS-DP-16).

The only significant source of uncertainty and error in petrographic description is mineral misidentification. Analysts are advised to refrain from making optical mineral identifications where the minerals are too fine-grained for adequate analysis or where the optical properties are ambiguous. Where mineral identifications must be ventured without certain optical identity, the notebook entry should be marked as "possible," "?," or otherwise queried. Uncertainties and errors in quantitative petrographic analyses are described in the relevant procedures (e.g., TWS-ESS-DP-102).

Petrographic descriptions are recorded in ink in a controlled laboratory or field notebook. Photographs may be attached as part of the description, and sketches may be used. It is advisable to mark or describe the scale of any photograph or sketch. Adequate notebook maintenance and review following TWS-QAS-QP-03 is required to determine that petrographic description activities have been adequately accomplished.

7.5 Sample/Site Traceability

Sample traceability is described in procedure TWS-ESS-DP-101. Site location traceability for field petrographic descriptions will be recorded in a controlled field notebook; field descriptions will reference map(s) or photograph(s) as appropriate. Copies of maps and photographs will be maintained by the investigator using them; upon task completion or departure of the investigator from the project, all records will be placed in the resident file and copied to the records processing center (RPC).

7.6 Verification of Key Actions

Key actions for this procedure are those that result in petrographic descriptions. Completed entries in controlled field or laboratory notebooks constitute verification.

8.0 QUALITY ASSURANCE REQUIREMENTS

8.1 Handling, Shipping, and Storage

Handling, shipping, and storage requirements are described in procedure TWS-ESS-DP-101.

8.2 Records

Petrographic descriptions are recorded in controlled laboratory or field notebooks. Maps or photographs should be marked with sample or locality numbers that can be uniquely related to a notebook entry (sample numbering requirements are described in procedure TWS-ESS-DP-101).

8.3 Training

Completion of at least one college-level course in petrography is required to use this procedure. Researchers using this procedure must also certify that they have read and understood it and procedure TWS-ESS-DP-101.

8.4 Calibration Requirements

Calibration is not required for the optical instruments covered by this procedure. Magnification scales and estimates are semi-quantitative. Where precise image measurements are required, it is recommended that the researcher use a procedure such as image analysis (see procedure TWS-ESS-DP-112).

8.5 Deviations and Nonconformances

Any special optical petrographic methods that might be used by a researcher shall be documented in a controlled laboratory notebook, following the requirements of TWS-MSTQA-QP-14. Any nonconformances will be handled according to TWS-MSTQA-QP-16.

9.0 APPENDICES

None.