Lithologic Log Addendum

Well BLM-26-404

Cuttings of the lithologic unit from well BLM-26-404 were sent to the Department of Geological Sciences, New Mexico State University (NMSU), Las Cruces, New Mexico, for detailed petrographic analysis when identification of fine-grained, highly altered volcanic rocks at the NASA-WSTF site became difficult using conventional field methods. Petrographic reports from NMSU were received after the printing of these lithologic logs, hence the need for this addendum. The petrographic description from NMSU is included below.

Previous unit name based on field identification: **Rhyolite**

New Unit name based on petrographic analysis: **Porphyritic Latite**

BLM-26-404 (330' - 335')

Porphyritic perlitic and pumiceous latite

Origin:	lava domes and associated pumice
Texture:	aphanitic porphyritic
Phenocryst mineralogy:	sanidine + plagioclase + biotite + FeTi oxides
Porosity:	10% in pumice fragments, moderate along fractures in perlite
Alteration:	moderate in most fragments, restricted to clay replacement of glass, but some fragments are granular calcite

Approximately 15% phenocrysts are present in a variety of glassy groundmass textures. Two groundmass textures are dominant: perlite with abundant conchoidal fractures, and welded pumice with continuous glass ribbons. The pumice fragments are moderately devitrified. Phenocryst assemblages in both are identical, with single crystals as well as glomerocrysts of sanidine + plagioclase + biotite + FeTi oxides. Sanidine crystals (7%, 0.5 - 2.0 mm) exhibit broken edges and strongly resorbed zones. Plagioclase phenocrysts (7%, 0.3 - 2.0 mm) are strongly zoned. Biotite (0.5%, 0.1 - 0.4 mm) has gold to red-brown pleochroism. FeTi oxides (0.5%, 0.1 - 0.4 mm) are present as microphenocrysts. A trace of apatite rods are present in feldspar phenocrysts. Porosity in pumice fragments is approximately 10%, but with very low permeability. Perlite fragments have moderate porosity along fractures. Alteration is very low permeability. Perlite fragments have moderate porosity along fractures. Alteration is very low in most grains, consisting largely of devitrification in pumice fragments and clay alteration of glass. However, fragments of granular calcite indicate veining somewhere in this interval. These samples probably originated as latite domes with their associated dome collapse and pumice deposits. This sample is very similar to BLM-26-404 (462').

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Well BLM-26-404 (cont'd)

BLM-26-404 (400' - 405')

Porphyritic biotite latite volcanic rocks

Origin:	silicic volcanic vent zone, mainly lava flows
Texture:	aphanitic porphyritic
Phenocryst mineralogy:	plagioclase + sanidine + biotite + FeTi oxides
Porosity:	variable from low to 10%, possibly higher along veins
Alteration:	extensive; mainly calcite replacing glass and groundmass minerals, chalcedony veins

Five different lithologies are present in this interval. Three of them (welded pumice, spherulitic obsidian, and variably devitrified perlite) have similar phenocryst assemblages, although phenocryst content varies between 5 and 13%. The other two lithologies are significantly different: matrix-supported sandstone (?) with calcite cement (possibly extensively altered versions of the volcanic rocks?) and one fragment of andesite. Brief descriptions follow.

Porosity is very difficult to estimate, but varies from low to probably 10%. The presence of calcite and chalcedony veins suggests substantial fluid flow along fractures.

Alteration is extensive in places, consisting largely of calcite replacing groundmass minerals and glass with complex veins containing several generations of chalcedony. This sample is much more altered than other samples from BLM-26.

Welded pumice: Highly vesicular, moderately devitrified, moderately welded glass pumice contains phenocrysts of sanidine, plagioclase, biotite, and FeTi oxides as described below under "spherulitic obsidian."

Spherulitic obsidian: Approximately 5-15% phenocrysts are surrounded by a glassy spherulitic groundmass. Plagioclase phenocrysts (0.5 - 3.0 mm) are the most abundant, and are complex. Sanidine is less abundant (plagioclase: sanidine = 2:1); crystals range from 0.4 to 0.7 mm. Biotite (0.1 - 0.7 mm) and FeTi oxides (0.05 - 0.2 mm) are present as accessory minerals. Quartz (0.1 mm) and zircon are present in trace amounts.

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Well BLM-26-404 (cont'd)

Perlite: Perlite and devitrified perlite are very similar to the obsidian, except for the presence of abundant conchoidal fractures.

Andesite: The andesitic fragments contain laths of plagioclase in a matrix of devitrified glass, biotite, and FeTi oxides.

Matrix-supported clastic rock: One fragment in this sample contains feldspar and quartz grains in a calcite cement, matrix-supported framework. This could be either a matrix-supported sandstone derived from the weathering of the volcanic pile, or an extreme alteration of the obsidian or perlite lithologies described above.

BLM-26-404 (462')

Porphyritic latite

Origin:	lava flow or dome
Texture:	aphanitic porphyritic
Phenocryst mineralogy:	sanidine + plagioclase + biotite + FeTi oxides
Porosity:	minimal
Alteration:	minor plagioclase alteration to clay

Approximately 17% phenocrysts are set in a fine-grained devitrified groundmass. Spherulites of K-feldspar and quartz are present in the groundmass; some fragments have perlitic textures. The phenocrysts exist as single crystals and plagioclase-biotite crystal clots. Sanidine phenocrysts (8%, 0.3 - 1.0 mm) are embayed and resorbed. Plagioclase phenocrysts (8%, 0.7 - 1.0 mm) are only weakly twinned and altered to clay, sometimes completely. Biotite (0.5%, 0.2 - 1.2 mm) is oxidized and has gold to red-brown pleochroism. FeTi oxides (0.5%, 0.05 - 0.4 mm) are present as microphenocrysts. Traces of zircon and apatite are also present. Porosity is very low. Alteration is limited to clay replacement of plagioclase phenocrysts; sanidine phenocrysts and the groundmass are quite fresh. This sample probably originated as a viscous lava flow or dome.