**VOLCANOES LANDFORM ASSOCIATIONS**

**Volcanoes:**

**Volcanoes**  are edifies, typically conical in shape, with a central summit vent that erupts effusive magmatic material as ash, cinder, blocks and or lava that accumulates and build up the landform.

**Glacial Processes**

***Glacial***

**Glacial Remnant Volcanoes** are the eroded roots of Tertiary volcanic mountains and which have clear geomorphic evidence of late glacial scour. This map unit has a radial stream pattern that drains to an encircling set of mainstem rivers. This drainage pattern is superposed on the underlying bedrock. Most or the entire volcanic massif is eroded away. In the core of the map unit roots of the volcano, include igneous stocks and hypabyssal intrusive rocks. Glacial scoured landforms include U-sped valleys with vertical to near-vertical walls and bedrock throughout, hanging valleys, cirques and arêtes. Glacial valleys may be differentiated where mappable at this scale.

**Glacial Volcanoes** are volcanoes that have beenshaped by present and past glaciers. These are the highest mountain peaks in the Pacific Northwest. Active glaciers are still present within this map unit, as well as icecaps and permanent snowfields. The terrain is glacially scoured, U-shaped valleys and moraines.

A limited variety of soil types are present on Glacial Volcanoes Landform Associations. Soils range from shallow soils to rock or exposed rock sediments are perched on the sides of these volcanic peaks. They have been exposed by the recession of glaciers and are subject to rapid erosion during rain on snow events. Soil taxa include Entisols, Andisols, Inceptisols and Spodosols.

***Glaciated***

**Glaciated Remnant Volcanoes** are deeply eroded Quarternary volcanoes that also have a history of glaciation. This map unit has a radial to annular stream pattern that is superposed on the underlying bedrock. Some massifs are more than half eroded away. The flanks of these volcanoes maintain the original conical base shape. The north and or east summit areas have cirque or cuirque-like landforms, as well as nivation features, talus slopes and block fields. In the core of the map unit, roots of the volcano include igneous hypabyssal intrusive rocks which form towering rock outcrops. Soils on this map unit are typically gravelly, shallow to bedrock and likely taxa are Andisols, Alfisols and Mollisols.

**Glaciated Volcanoes** are volcano cones shaped by both past glaciers and more recent geomorphic processes. Volcanoes are edifies, typically conical in shape, with a central summit vent that erupts effusive magmatic material as ash, cinder, blocks and or lava that accumulates and build up the landform.

Along peaks and ridges there are indicators of past glacial action. The terrain is glacially scoured with cirque basins, icefields, and U-shaped valleys. Cirque valley bottoms and small valley areas may be included in this map unit where unmappable as Glacial Valleys Landform Association. Since the cessation of glaciation in these areas, however, surface, mass wasting (shallow rapid or deep seated earthflow, rockfall, etc.) or fluvial erosion processes have dominated and masked much of the glacial signature of the mid to lower slopes.

**Glaciated Volcanoes (Mazama)** are remnant ramparts of Mt. Mazama Volcano which have been shaped by both past glaciers and more recent geomorphic processes. Along peaks and ridges there are indicators of past glacial action. The terrain is locally glacially scoured, with hanging valleys, cirque basins, icefields, and U-shaped. The ramparts of the Mt Mazama Volcano and satellite volcanoes are blanketed with pumiceous tephra and eruptive debris from the volcano’s eruption and collapse. In addition to the eruption, erosion and degradation of this landscape have muted the late glacial and earlier glacial landforms in this mountainous area. Deep incision of the tephra and subsequent glacial deposits has developed narrow, slot canyons and impressive erosional features. Extant deposits and tephra blanket has developed Andisols soil taxa.

**Mass Wasting Processes**

**Collapsed Volcanoes** outline the collapse debris of Mt. St. Helens. The failure covers many miles from the summit crater. The debris consists of large fragments of the Glacial Volcano as evident by large hills of exogenous bedrock in the former locations of Spirit Lake and Toutle River headwater valleys. These blocks are immersed in lahar deposits resulting from the admixture of eruptive tephra, bedrock and melted glaciers. If soil is present, the soils are in the taxa Entisols and Andisols are present in this map unit.

**Dissected Volcanic Low Mountains** are areas of where a series of volcanoes once occupied the landscape and belong to the low mountain relief class. The original volcanoes are Tertiary to Quaternary in age. Over time they have been subjected to weathering and concentration of surface runoff to result in fluvial erosion and slope mass wasting that eroded V-shaped valleys into the sides of the volcanoes and through the series of volcanic peaks. It is no longer evident what the landscape was like previously. Some slope angles are greater than repose and are bare rock or outcroppings. Thickest soils gather in valley bottoms and collect in tributary headwalls.

**Dissected Volcanic Mountains** areareas wherevolcanoes once occupied the landscape and belong to the mountain relief class. The original volcanoes are Tertiary to Quarternary in age. Dissected Volcanic Mountain landscapes have developed distinct stream systems. The stream channels have V-shaped valley walls that are linear-linear in form from ridge-top to valley bottom. It is no longer evident what the landscape was like previously. Some slope angles are greater than repose and are bare rock or outcroppings. Thickest soils gather in valley bottoms and collect in tributary headwalls.

**Incised Shield Volcanoes** are shield volcanoes whereweathering and erosion are just beginning to alter the topography of the area. Incised refers to landscapes and landforms that retain their outlines and the majority of their mass but are experiencing an initial alteration of form. The accumulation of fluid basalt from a central vent area yields a convex shield-like landform. The vent area may have developed a late-stage eruptive edifice with steep, rocky slopes. The shield may have locally accumulated tephras that issued from the vent, particularly late in the volcano’s development.

Soils developed on this map unit vary from residual, thin rocky soils on the flows, to ashy horizons over this residual soil, to thicker, less-rocky soils in depressions and lower slope positions along fault zones.

**Incised Volcanoes and Flows** are landscapes created by volcanoes and their associated lava flows and that have undergone weathering and fluvial erosion to the extent that their original landforms are degraded yet still recognizable. This landscape may locally have been covered by fluvial deposits, such as in intra-flow depressions, which have been eroded as well. The appearance of distinct V-shaped channels throughout is the key difference from the younger or less degraded Volcanoes and Flows. The volcanoes are typically of the cinder cone type and these have a near summit depression that sometimes open out onto the landscape and become part of the integrated drainage system. Volcano summits are typically rounded off and side slopes may have gullies indicating soil profile development and the consequent decrease in transmissivity. Stream incision styles range from a sinuous, single threaded mainstem channel with limited tributaries, to dense and equally distributed networks of branching V-shaped channels.

Differential erosion along the margins of volcanoes and their associated lava flows yields mesa or low-relief plateau types of landforms. The volcanic rock shields this landscape from erosional land lowering as fast as adjacent landscapes.

Soils on this landscape are mature and have developed horizons that impede transmission of soil water, thence leading to the development of drainage networks. Soil taxa range from Mollisols with duripans (in dry climates) to Andisols (in humid climates).

**Tectonic Processes**

**Faulted Glaciated Volcanoes** are volcanoes with evidence of past glaciation and faulting. Along the volcanic peaks and ridges there are indicators of past glacial action. Though marred by degradation, the terrain appears glacially scoured with cirque basins, icefields, and U-shaped valleys. Since the cessation of glaciation in these areas, however, surface, mass wasting (shallow rapid or deep seated earthflow, rockfall, etc.) or fluvial erosion processes have dominated and masked much of the glacial signature of the mid to lower slopes. These volcanoes are cut by faults leaving a series of fault scarps that displace bedrock blocks and divert former stream channels to zig-zag courses. Soils are thin to absent om the rocky slopes and thick and rocky along lower (footslope, toeslope) slope positions. Soil taxa are typically Andisols, Alfisos and Mollisols.

**Faulted Incised Volcanoes** are volcanoes whereweathering and erosion are just beginning to alter the topography of the area and that exhibit fault deformation. Incised refers to landscapes and landforms that retain their outlines and the majority of their mass but are experiencing an initial fluvial and mass wasting of form. These volcanoes are cut by faults leaving a series of fault scarps that displace bedrock blocks and divert former stream channels to zig-zag courses. Soils are thin to absent om the rocky slopes and thick and rocky along lower (footslope, toeslope) slope positions. Soil taxa are typically Andisols, Alfisos and Mollisols.

**Faulted Shield Volcanoes** are shield volcanoes that exhibit fault deformation. The accumulation of fluid basalt from a central vent area yields a convex shield-like landform. The vent area may have developed a late-stage eruptive edifice with steep, rocky slopes. The shield may have locally accumulated tephras that issued from the vent, particularly late in the volcano’s development. These volcanoes are cut by faults leaving a series of fault scarps that displace bedrock blocks and divert former stream channels to zig-zag courses.

Soils developed on this map unit vary from residual, thin rocky soils on the flows, to ashy horizons over this residual soil, to thicker, less-rocky soils in depressions and lower slope positions along fault zones.

**Faulted Volcanic Terrain** is a miscellaneous map unit that includes diverse landform elements associated with the numerous volcanoes in the volcanic fields of central and eastern Oregon. This terrain is dominantly constructive topography associated with basaltic volcanoes, including cinder cones, conical volcanoes, shield volcanoes and maars. The extensive lava flows of these volcanoes are not differentiated. Tephra from local volcanic sources, pumiceous tephra from Mt. Mazama, and or andesitic tephra form the Cascade Range volcanoes blanket some or this entire map unit.

Weathering, fluvial erosion and, to a large degree, mass wasting have degraded these constructional landforms. Shed sediments are deposited in fluvial fans, plains and terraces which can represent significant extents within this map unit. This volcanic terrain is cut by faults leaving a series of fault scarps that displace bedrock blocks and divert former stream channels to zig-zag courses. Soils are thin to absent pm the rocky slopes and thick and rocky along lower (footslope, toeslope) slope positions. Soil taxa are typically Andisols, Alfisos and Mollisols.

**Faulted Volcanoes** are volcanoes that exhibit displacement by faults. Volcanoes are edifies, typically conical in shape, with a central summit vent that erupts effusive magmatic material as ash, cinder, blocks and or lava that accumulates and build up the landform. These volcanoes are cut by faults leaving a series of fault scarps that displace bedrock blocks and divert former stream channels to zig-zag courses. Soils are thin to absent pm the rocky slopes and thick and rocky along lower (footslope, toeslope) slope positions. Soil taxa are typically Andisols, Alfisos and Mollisols.

**Volcanic Processes**

**Crater Rims** are basin-like, rimmed structure that is usually at the summit of a volcanic cone. It may be formed by collapse, by an explosive eruption, or by the gradual accumulation of pyroclastic material around a vent. Crater Rims are dominantly rock slopes well exceeding the angle of repose. Rock debris clings to these steep slopes in places and along the base of the rim in the form of blockfieds. Crater Rims may be submerged at their base by a crater filling lake (e.g. Crater Lake). Soils are thin and rocky when present.

**Lava Flows** are areas covered by volcanic lava rock and for which a source ventis not mappable at this scale or is no longer directly contiguous. This map unit locally includes lava units that flowed down river valleus and through differential erosion of the bedrock along the valley walls, the lava flow is now a mesa, an example of “inverted topography.”

Soils on lava flows are age and climate dependent. Young lava flows may have little or no soil development, unless in humid areas where Histosols may develop. Older lava flows have Andisols where humid to Mollisols (commonly with duripans) where dry.

**Maars** are a low-relief, broad volcanic crater formed by multiple shallow explosive eruptions. It is surrounded by a crater ring, and may be filled by water during wet seasons. The top of the crater wall transitions to an asymmetric berm that encircles the crater. The berm represents the ejected ballistic debris. The greatest accumulation and relief is nearest the crater wall. Talus to debris cones accumulate along the lower portions of the crater wall.

Soils tend to be coarse, gravelly to rocky nearest the crater wall and become finer texture towards the crater center and out, away from the berm crest. Soil taxa are typically Mollisols and Andisols, the latter most likely where ash has accumulated.

**Remnant Volcanoes** are deeply eroded Quaternary volcanoes. This map unit has a radial to annular stream pattern that is superposed on the underlying bedrock. Some massifs are more than half eroded away. The flanks of these volcanoes maintain the original conical base shape. In the core of the map unit, roots of the volcano include igneous hypabyssal intrusive rocks which form towering rock outcrops. Soils on this map unit are typically gravelly, shallow to bedrock and likely taxa are Andisols, Alfisols and Mollisols.

**Shield Volcanoes** are volcanoes formed by the accumulation of fluid basalt from a central vent area yields a convex shield-like landform. The accumulation of fluid basalt from a central vent area yields a convex shield-like landform. The vent area may have developed a late-stage eruptive edifice with steep, rocky slopes. The shield may have locally accumulated tephra that issued from the vent, particularly late in the volcano’s development.

Soils developed on this map unit vary from residual, thin rocky soils on the flows, to ashy horizons over this residual soil, to thicker, less-rocky soils in depressions and lower slope positions along fault zones.

**Volcanic Terrain** is a miscellaneous map unit that includes diverse landform elements associated with the numerous volcanoes in the volcanic fields of central and eastern Oregon. This is a diverse terrain all with a volcanic origin including volcanoes, flows, lava tubes and caves, parasitic volcanoes superimposed on a volcano or a flow. This terrain is dominantly constructive topography associated with basaltic volcanoes, including cinder cones, conical volcanoes, shield volcanoes and maars. The extensive lava flows of these volcanoes are not differentiated. Tephras from local volcanic sources, pumiceous tephra from Mt. Mazama, and or andesitic tephra form the Cascade Range volcanoes blanket some or this entire map unit.

Weathering, fluvial erosion and, to a large degree, mass wasting have degraded these constructional landforms. Shed sediments are deposited in fluvial fans, plains and terraces which can represent significant extents within this map unit. Soils are thin to absent om the rocky slopes and thick and rocky along lower (footslope, toeslope) slope positions. Soil taxa are typically Andisols, Alfisos and Mollisols.

**Volcanoes**  are edifies, typically conical in shape, with a central summit vent that erupts effusive magmatic material as ash, cinder, blocks and or lava that accumulates and build up the landform.

Volcanoes are Quaternary in age. Relief of Volcanoes Landform Association is in the range of hills to low mountains. Slopes vary from angle of repose or greater (>50%) on younger volcanoes to <10% on older, degraded volcanoes; soil profile development is inversely related in that lower slope gradients corresponds to mature soils, which are taxonomically classified as Andisols and Alfisols.

**Volcanoes and Flows** are volcanoes and their associated lava flows. The volcanoes are typically cinder cones which are conical in shape with steep sides formed by pyroclastic flows and air fall blocks. The cone is often breached by asymmetric basalt flows less commonly by flows of andesite or obsidian. Cones can be constructed by the full range of volcanic materials from basalt to andesite to dacite. Volcano summits are typically rounded off and side slopes may have gullies indicating soil profile development and the consequent decrease in transmissivity. Stream incision styles range from a sinuous, single threaded mainstem channel with limited tributaries, to dense and equally distributed networks of branching V-shaped channels.

Differential erosion along the margins of volcanoes and their associated lava flows yields mesa or low-relief plateau types of landforms. The volcanic rock shields this landscape from erosional land lowering as fast as adjacent landscapes.

Soils on this landscape are mature and have developed horizons that impede transmission of soil water, thence leading to the development of drainage networks. Soil taxa range from Mollisols with duripans (in dry climates) to Andisols (in humid climates). Lava flows can be recent exposures of raw lava or tree covered depending on environment.

**Volcano Mountains** are volcanoes whose relief class are mountains and are not otherwise distinguished. Volcano Mountains are edifies, typically conical in shape, with a central summit vent that erupts effusive magmatic material as ash, cinder, blocks and or lava that accumulates and build up the landform.

Volcanoes in this undifferentiated unit lack one or more of the characteristic that would place them into one of the other volcano map units. Slopes vary from angle of repose or greater (>50%) on younger volcanoes to <10% on older, degraded volcanoes; soil profile development is inversely related in that lower slope gradients corresponds to mature soils, which are taxonomically classified as Andisols and Alfisols. High elevation areas tend to develop Spodosols either because of age, summit elevation and or latitude. These volcanoes lack defining features of glaciation. If of Pleistocene in age, these peaks must have been below the equilibrium line altitude for ice accumulation to have formed glaciers. If summits are above the Pleistocene equilibrium line altitude, then they must be too young (i.e. Holocene) to have accumulated ice to form glaciers.