Supplement to "Small-volume basaltic volcanoes: eruptive products and processes, and post-eruptive geomorphic evolution in Crater Flat (Pleistocene), southern Nevada" by Valentine et al.

TERMINOLOGY

The formal names of the eruptive centers include the word *cone* (e.g., Red Cone), and we modify these with the word *volcano* to refer to the combination of lavas and pyroclastic materials and their associated landforms for an eruptive center. The word *cone* is restricted to that specific landform. The term *lava flow field* (or *lava field*) indicates an area that is covered with multiple lava flow units emplaced by multiple mechanisms such as stacking of flow units and inflation. This differs somewhat from the term *compound lava*, which we reserve for stacks of flow units (following Walker, 1973; Francis, 1993), but is similar to the use of *compound lava field* by Pinkerton and Sparks (1976) and Duncan et al. (2004). The topographic high formed by accumulation of lavas is referred to as a lava *platform*. *Bocca* refers to a vent, typically located at the foot of a scoria cone, that feeds lava flows and has little if any pyroclastic component. Terms to describe pyroclast size and shape (e.g., ash, lapilli, block, bomb) follow definitions in Fisher and Schmincke (1984). Some of the deposits we describe below are welded to various degrees, ranging from *partly welded* (or *sintered*, where clasts are stuck together where they touch, but are not deformed) to *completely* or *densely welded* (clasts have flattened, lost their porosity, and coalesced to form a lava-like mass that may contain relict clast textures), with *moderately welded* referring to an intermediate state between these two end members where clasts are deformed but still easily distinguished and some original porosity remains. *Agglutinate* refers to coarse (large lapilli to blocks and bombs) deposits that are welded to some degree. *Primary* refers to deposits or features that are

directly caused by volcanic processes, as opposed, for example, to reworked deposits that have been modified or mobilized and subsequently re-deposited by the action of water and/or wind after eruptions ceased.

Three types of explosive eruptions are discussed in this paper. *Strombolian* eruptions are characterized by pulsed or discrete explosions resulting from bursting of gas pockets from a magma column, producing mainly coarse, fluidal clasts with ballistic trajectories near the vent and scoria lapilli on outer slopes (e.g., Vergniolle and Mangan, 2000; Vespermann and Schmincke, 2000). *Violent Strombolian* events (also referred to as "transitional" by Parfitt, 2004) are characterized by rapidly pulsed or steady eruptions of well-fragmented pyroclasts to form sustained eruption columns from which clasts are deposited by fallout, with less abundant ballistic bombs (e.g., Valentine, 1998; Arrighi et al., 2001; Valentine et al., 2005). The eruption columns may be on the order of hundreds of meters to a few kilometers in height. *Hydrovolcanic* events are driven by explosive interaction between magma and groundwater or surface water.

This paper also refers to geomorphic features such as surface mosaics and desert pavements. *Surface mosaic* refers to the arrangement of clasts on surfaces and is typically classified according to the fraction of open space between clasts and their size range (e.g., Wood et al., 2002). In an arid to semi-arid environment, the surface of a lava flow will evolve through a combination of mechanical weathering of highs on the lava surface, accumulation of eolian sediment (particularly in low spots and swales) and finally the accumulation of pedogenic carbonates and relatively active erosion (e.g., Wells et al., 1985). The characteristics of surface mosaics provide a measure of that surface evolution process. *Desert pavements* are one-clast-thick surface layers of

relatively tightly fitted, lapilli-sized clasts that form concurrently with the accumulation of underlying eolian soils (e.g., McFadden et al., 1987; Valentine and Harrington, 2006).

References

Arrighi, S., Principe, C., and Rosi, M., 2001, Violent strombolian and subplinian eruptions at Vesuvius during post-1631 activity: Bulletin of Volcanology, v. 63, p. 126-150.

Duncan, A.M., Guest, J.E., Stofan, E.R., Anderson, S.W., Pinkerton, H., and Calvari, S., 2004, Development of tumuli in the medial portion of the 1983 aa flow-field, Mount Etna, Sicily: Journal of Volcanology and Geothermal Research, v. 132: 173-187.

Fisher, R.V., and Schmincke, H.-U., 1984, Pyroclastic rocks: Berlin, Springer-Verlag, 472 pp.

Francis, P., 1993, Volcanoes, a planetary perspective: New York, Oxford University Press, Inc., 443 pp.

McFadden, L.D., Wells, S.G., and Jercinovich, M.J., 1987, Influences of eolian and pedogenic processes on the origin and evolution of desert pavements: Geology, v. 15, p. 504-508.

Parfitt, E.A., 2004, A discussion of the mechanisms of explosive basaltic eruptions: Journal of Volcanology and Geothermal Research, v. 134, p. 77-107.

Pinkerton, H., and Sparks, R.S.J., 1976, The 1975 sub-terminal lavas, Mount Etna: a case history of the formation of a compound lava field: Journal of Volcanology and Geothermal Research, v. 1, p. 167-182.

Valentine, G.A., 1998, Eruption column physics, *in* Freundt, A., and Rosi, M., eds., From Magma to Tephra: Modeling Physical Processes of Explosive Volcanic Eruptions: Elsevier, Amsterdam, Elsevier, p. 91-138.

Valentine, G.A., and Harrington, C.D., 2006, Clast size controls and longevity of Pleistocene desert pavements at Lathrop Wells and Red Cone volcanoes, southern Nevada: Geology, in press.

Valentine, G.A., Krier, D., Perry, F.V., and Heiken, G., 2005, Scoria cone construction mechanisms, Lathrop Wells volcano, southern Nevada, USA: Geology, v. 33, p. 629-632.

Vergniolle, S., and Mangan, M., 2000, Hawaiian and Strombolian eruptions: *in*: Sigurdsson, H., ed., Encyclopedia of Volcanoes: San Diego, Academic Press, p.447-461.

Vespermann, D., and Schmincke, H.-U., 2000, Scoria cones and tuff rings: *in*: Sigurdsson, H., ed., Encyclopedia of Volcanoes: San Diego, Academic Press, p.683-694.

Walker, G.P.L., 1973, Lengths of lava flows: Philosophical Transactions of the Royal Society of London, Series A, v. 274, p. 107-118.

Wells, S.G., Dohrenwend, J.C., McFadden, L.D., Turin, B.D., and Mahrer, K.D., 1985, Late Cenozoic landscape evolution on lava flow surfaces of the Cima volcanic field, Mojave Desert, California: Geological Society of America Bulletin, v. 96, p. 1518-1529.

Wood, Y.A., Graham, R.C., and Wells, S.G., 2002, Surface mosaic map unit development for a desert pavement surface: Journal of Arid Environments, v. 52, p. 305-317.