Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36982

# Melt heterogeneity linked to shifts in eruption style during the 1980-86 Mount St Helens eruptions

**FRANCES E JENNER**[1], JONATHAN D. BLUNDY[2], BARBARA E KUNZ[1], COLETTE COUVES[3], LINDA MARVIN[4], KIM BERLO[5] AND MICHAEL CLYNNE[6]

[1]The Open University
[2]University of Oxford
[3]University of Bristol
[4]University of Leicester
[5]McGill University
[6]United States Geological Survey

The 1980–1986 eruptions of Mount St. Helens (MSH) began with explosive Plinian activity and transitioned to predominantly dome-building eruptions in October 1980. The eruption-style change has been attributed to waning magma supply and an increase in viscosity of progressively $H_2O$-depleted magmas. The range of melt inclusion, matrix glass and whole-rock compositions of 1980-86 MSH dacites was thought to reflect degassing and crystallisation of nearly homogenous parental melts at different pressures prior to eruption. The occurrence of one 18$^{th}$ May, 1980, melt inclusion with significantly higher Nb than other inclusions received little attention until analyses of amphibole grains revealed bimodal Nb populations and amphibole equilibrium melt compositions similar to the Nb-rich inclusion [1]. It is unclear whether the trigger for 1980-86 magmatism, and the change in eruption style on October 16$^{th}$, 1980, resulted from addition of high-temperature, high-Nb magmas to the system, or if the dacites scavenged ancient amphiboles and the high-Nb inclusion from the subsurface magmatic system during ascent.

**Our new whole rock, melt inclusion and matrix glass analyses of 1980-86 MSH samples show** the transition in eruption style coincides with a change in dacite chemistry to higher Nb, Mo, Y and Ba/Nb, and the appearance of volcanic glasses with bimodal $K_2O$ concentrations. The compositional shift is comparable to those seen in previous eruptive periods at MSH, which have been attributed to mixing between resident low-Nb, high-$H_2O$ dacites with hotter more Nb-rich, $H_2O$-poor basalts [2]. Compositional changes in October 1980 cannot be explained by crystallization alone. Instead, they reflect intrusion of chemically distinct, high-Nb mantle-derived melts into the mush zone beneath MSH, which likely supplied gasses to overlying dacites prior to Plinian eruptions. Mixing between the high-Nb magmas and resident $H_2O$-depleted dacites likely contributed to the subsequent eruption-style shift to dome-forming eruptions.

[1] Humphreys, M.C.S. et al. (2019) Magma plumbing at Mount St. Helens: new amphibole partitioning scheme. Contrib. Mineral. Petrol. 174, 9.

[2] Keller, F. et al. (2024) Amphibole perspective on recent magmatic evolution of Mount St. Helens. J. Petrol. 65.