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Compton Belkovich Volcanic Complex - Evolved Magmatism on the Moon

MATTHEW SIEGLER[1], RITA ECONOMOS[2], KRISTEN BENNETT[3], BENJAMIN GREENHAGEN[4] AND TYLER POWELL[4]

[1]University of Hawaii at Manoa
[2]University of Hawai‘i at Mānoa
[3]Northern Arizona University
[4]Johns Hopkins Applied Physics Laboratory

Comparative planetology allows for the study of igneous systems under conditions not found on present-day Earth. The case of the Compton-Belkovich Volcanic Complex (CBVC) on the lunar farside offers a nearly pristine example of evolved silicic volcanism in a system believed to have little water, stretching the understanding of how such large-scale evolved systems can occur. These systems are useful for comparison to the very early Earth and the evolution of cratonic crust.

A collection of evidence from several international orbital missions (US, China, India) revealed the surprising scale and evolved state of this system. This includes evidence of a subsurface ~50km wide granitic batholith which underlies this feature. Production of this quantity of evolved materials requires the early farside to have a vast source of radiogenic material (possibly a farside KREEP layer), excess heat (possibly a past mantle plume) or water (which is surprising on the weakly hydrated Moon) to facilitate second-stage melting or fractionation.

Last believed to have erupted over 3.5 Gya, the CBVC includes an intact caldera structure and evidence of pre and post eruptive volcanism evidenced to range in composition, with structures that are recognizable from Earth analog calderas. These features include a silicic edifice, which collapsed along roughly 13km diameter ring faults, a large ashfall deposit, and later stage blocky-dome forming eruptions.

Orbital constraints show the CBVC to be one of the highest concentrations of Th on the Moon, supporting the concept of a highly radiogenic source, unknown up to this point beneath the thick farside highlands crust.

Overlain orbital measurements of Si (diviner) and H2O (M3) show that this region is one of the most silicic and most hydrated on the moon. We will present a detailed analysis of these data together with the interpretation of volcanic structures, allowing for comparison with Earth analog volcanic systems.

All combined, this appears to be a highly-evolved, granitic system occurring in a body thought to be nominally anhydrous and lacking plate tectonics. This provides a unique contribution to our knowledge of the range of processes that can produce large volumes of silicic magma in the solar system.