GEOLOGY OF THE MOHON MOUNTAIN VOLCANIC FIELD, YAVAPAI AND MOHAVE COUNTIES, ARIZONA: A PRELIMINARY REPORT

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The Mohon Mountains form the center of a volcanic field which covers a 500 km^2 area of west-central Arizona. The field consists of scattered plugs, domes, and flows that surround a central silicic complex. Mohon Mountain is the highest peak in the central vent area. It rises to an elevation of 2273 m, with 909 m of local relief above the surrounding plateau basalts and volcaniclastic covered plains.

The Mohon Mountains are located in the southern transition zone between the Basin and Range and Colorado Plateau provinces. This 100 km wide arc exhibits structural, volcanic, and petrologic characteristics of both provinces. The Mohon Mountains are bounded on the north by the Aquarius Mountains caldera. Basalts at the base of the Aquarius pile were dated by K-Ar methods at 24 m.y. (Fuis, 1974). To the west the Mohons are bounded by Precambrian granites and granodiorites of the Aquarius Cliffs. These are upwarped to the west and form a sharp boundary with downdropped Basin and Range structures along the north-south trending Big Sandy graben. To the south the Mohons are bounded by undated plateau basalts of Goodwin Mesa. The Mohon volcanic field extends eastward past Mount Hope, a rhyodacite dome that has been K-Ar dated at 8.0 ± 0.5 m.y. (Simmons, 1986). The field is bounded on the east by the basalt-capped Juniper Mountains, which include the farthest eastward exposures of Paleozoic strata in the transition zone.

The age of volcanism in the Mohon Mountains can be constrained by relationships found in Gonzales Wash in the northwestern portion of the Mohon field. Exposed in this canyon tributary of Trout Creek is 30 m of Peach Springs Tuff, a widespread ignimbrite unit with a mean K-Ar age of 18.2 m.y. (Glazner et al., 1986). The Peach Springs Tuff overlies breccias which were derived from the Aquarius Mountains to the north. It is covered by Mohon basalts and breccias. Based on the stratigraphic relationships in Gonzales Wash, the younger age of overlying Mount Hope flows to the east, and a generally younging northeastward trend of volcanics on the southern edge of the Colorado Plateau (Arney et al., 1980), the age of Mohon volcanism can be narrowed to between 18 and 9 m.y. (Mid Miocene). The Gonzales Wash section shows a conformable contact between the Peach Springs Tuff and overlying basalts so that the period of time between deposition of the Peach Springs Tuff and Mohon-derived basalts may have been geologically brief.

The Mohon Mountain vent complex was highly explosive. The 152 km^2 area of the central eruption is composed almost exclusively of tuff breccia conglomerates. Ridges are usually capped by more resistant flow remnants. Blocks in the breccias are of two types. A plagioclase phenocryst-rich assemblage dominates to the north and west, whereas a vitric, hornblende-rich and plagioclase-poor assemblage dominates to the south and east. Both may be found in any given region, however, and they do not show a consistent stratigraphic relationship, although statistically hornblende breccia overlies plagioclase breccia. This suggests that the two types were produced by a number of pulses from the same vent or from nearby vents that tapped different portions of a magma chamber, with hornblende breccia erupting dominantly during later stages. The flow remnants mimic underlying breccia blocks in composition.

The central vent complex of Mohon Mountain is subcircular and is breached on its southern flanks by two explosively produced basins which are together believed to be the erosional remnants of the vent area. The basins are bridged by low ridges which preserve resistant plugs that were part of the internal portion of the vent. Mohon Mountain is rimmed on the north and west by peripheral endogenous domes at Black Butte, Walker Mountain, and Palomino Peak. Two other explosive vents at the southern border of Mohon Mountain produced rhyodacitic and dacitic flows and tuff breccias at Pilot Knob and Red Canyon. These domes and explosive vents are younger and produced smaller volumes of lava than those of Mohon Mountain. Before and after eruption at Mohon Mountain, tholeiitic plateau basalts were extruded from fissures in the southwestern and southeastern portions of the field, giving evidence that production of both basaltic and silicic magmas occurred throughout the period of active volcanism. Following eruption at the peripheral domes and explosive vents, alkalic megacryst-bearing basalts and basaltic andesites were extruded through numerous northwest-trending dikes and cinder cones. The last stage of activity was the eruption of ash flow tuffs from the Mount Hope vent to the east, followed by growth of the Mount Hope dome. A north-south trending graben 4.4 km wide borders the eastern flank of Mount Hope and was probably active during the final stage of activity.

Chemistries of the Mohon volcanics appear to be more similar to those found along the southern margin of the Colorado Plateau than to those in the Basin and Range. Basin and Range volcanics are characterized by bimodal assemblages of alkalic basalts and high-silica rhyolites (Suneson and Lucchitta, 1983). Most Colorado Plateau margin volcanics have chemistries mildly alkaline in basalts to calc-alkaline in more silicic rocks (Wenrich-Verbeek, 1979), although some tholeiites occur along the Plateau margin in Arizona (Simmons, 1986).

Chemical diversity in basalts may be characteristic of tectonically transitional regimes. Variation of tholeiitic and alkalic basalt, reflecting magma generation over a large depth range in the mantle, occurs in marginal areas between structural provinces. This suggests that the bounding discontinuities between provinces may extend through the crust and affect the entire lithospheric plate to influence magma generation at upper mantle depths (Lipman and Moench, 1972).

Field mapping has produced a preliminary picture of Mohon Mountain as a composite volcano, in which pyroclastic ash and larger tephra erupted alternately with flows of rhyodacite and dacite. An analog study which uses imagery of lunar and martian features will compare the overall shape of the vent complex, including its breached southern flank and satellite vents, to similar landforms found on Mars and the moon which are believed to have formed by similar processes. Ash flow sheets were hypothesized to comprise the outer slopes of Olympus Mons (King and Riehle, 1974), suggesting that explosive eruptions which are more volatile-rich than those which produce basalt flows are not confined to terrestrial settings but may also be found on bodies such as Mars, which have a thicker crust and deeper magma source in the mantle. The analog study will explore further evidence for explosive eruptions on Mars and the moon.

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