

TRACKING THE EVOLUTION OF MID CENOZOIC SILICIC MAGMA
SYSTEMS IN THE SOUTHERN CHOCOLATE MOUNTAINS REGION,
CALIFORNIA USING ZIRCON GEOCHEMISTRY AND QUARTZ AND
ZIRCON GEOTHERMOMETRY

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ABSTRACT

Sarah Katherine Needy

TRACKING THE EVOLUTION OF MID CENOZOIC SILICIC MAGMA SYSTEMS IN THE SOUTHERN CHOCOLATE MOUNTAINS REGION, CALIFORNIA USING ZIRCON GEOCHEMISTRY AND QUARTZ AND ZIRCON GEOTHERMOMETRY

During the mid Cenozoic, the Chocolate Mountains region of southeastern California experienced crustal extension slightly before, during, and after the main pulse of magmatism. This combined with mid-late Cenozoic faulting to locally uplift plutonic rocks interpreted to represent the plumbing system(s) for volcanic units, allowing an examination of both the extrusive and intrusive result of magmatism.

Zircon U-Pb ages of from six magmatic units yield late Oligocene to early Miocene ages and correlate better with stratigraphic relationships than previously compiled ages. These units are four silicic volcanic units – Quechan volcanic rocks, tuff of Felipe Pass, ignimbrite of Ferguson Wash, and tuff of Black Hills – and two plutonic units – the granites of Mount Barrow and Peter Kane Mountain. Regarding contemporaneous plutonic systems as baseline comparisons, zircons from the volcanic units commonly record plutonic temperatures; interpreted to be solidus or near solidus temperature. Remobilization may be a common process leading to eruption.

Quartz and zircon thermometers reveal the ignimbrite of Ferguson Wash and tuff of Black Hills magmatic systems evolved differently. Quartz yields temperatures of 700°C to ~750°C in both units with no core-rim trends. Cores of zircons from the

ignimbrite of Ferguson Wash yield temperatures between 750°C and 890°C. Zircon rim temperatures are between 875°C and 950°C. Tuff of Black Hills zircon cores generally record temperatures of ~850°C and zircon rim temperatures are ~700°C. Rims from tuff of Black Hills zircon record the same temperature range as zircons from coeval granites.

The temperature increase from core to rim in zircons from the ignimbrite of Ferguson Wash indicates reheating and that zircon grew later than and at higher temperatures than quartz. The low zircon temperatures from tuff of Black Hills reveals a system that was growing quartz and zircon at the same low, nearly solidus temperatures. Reasons for its eruption are not readily apparent in the thermal history of zircon and quartz. These two systems record different thermal histories than previously studied, younger systems like the Bishop tuff, in which quartz records late reheating just prior to eruption and a system that was growing quartz later and at higher temperatures than zircon.

Andrew Barth, Ph.D., Committee Chair

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