The mantle and basalt-crust interaction below the Mount Taylor Volcanic Field, New Mexico

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The Mount Taylor Volcanic Field (MTVF) lies on the Jemez Lineament on the southeastern margin of the Colorado Plateau. The field is centered on the Mt. Taylor composite volcano and includes Mesa Chivato to the NE and Grants Ridge to the WSW. MTVF magmatism spans ~3.8-1.5 Ma (K-Ar, Perry et al., 1990). Magmas are dominantly alkaline with mafic compositions ranging from basanite to hy-basalt and felsic compositions ranging from ne-trachyte to rhyolite. We are investigating the state of the mantle and the spatial and temporal variation in basalt-crustal interaction below the MTVF by examining mantle xenoliths and basalts in the context of new mapping and future Ar-Ar dating.

The earliest dated magmatism in the field is a basanite flow south of Mt. Taylor (Perry et al., 1990). Mantle xenolith-bearing alkali basalts and basanites occur on Mesa Chivato (Crumpler, 1980) and in the region of Mt. Taylor, though most basalts are peripheral to the main cone. Xenolith-bearing magmatism persists at least into the early stages of cone-building. Preliminary examination of the mantle xenolith suite suggests it is dominantly lherzolitic but contains likely examples of both melt-depleted (harzburgitic) and melt-enriched (clinopyroxenitic) mantle.

There are aphyric and crystal-poor hawaiites, some of which are hy-normative (Perry et al., 1990), on and near Mt. Taylor, but many of the more evolved MTVF basalts show evidence of complex histories. Mt. Taylor basalts higher in the cone-building sequence contain >40% zoned plagioclase pheno- and megacrysts. Other basalts peripheral to Mt. Taylor and at Grants Ridge contain clinopyroxene and plagioclase megacrysts and cumulate-textured xenoliths, suggesting they interacted with lower crustal cumulates.

Among the questions we are addressing: What was the chemical and thermal state of the mantle recorded by the basaltic suites and xenoliths and how did it change with time? Are multiple parental basalts (Si-saturated vs. undersaturated) represented and, if so, what changes in the mantle or in the tectonic regime allowed their coexistence or caused the transition?
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Introduction

The Mount Taylor Volcanic Field (MTVF) lies on the Jemez Lineament in the southwestern margin of the Colorado Plateau. The field is centered on the Mount Taylor (MT) composite volcano and includes Grants Ridge in the west, Mesa Chivato (MC) and the Rio Puerco (RP) volcanic necks in the NE. MTVF magnetism spans 3.5–1 Ma (Hall, Perry, et al., 1989). Melt inclusions are variably altered with compositions ranging from basanites to hawaiites. We are investigating the state of the mantle and the spatial and temporal variation in basaltic crustal interaction below the MTVF by examining mantle xenoliths and basalt in the context of new imaging and geochemical analysis.

The earliest dated MTVF magnetism is a basaltic flow south of Mt. Taylor (Perry et al., 1990). Basaltic xenolith-bearing volcanic breccias and basaltic breccias occur on Mesa Chivato (Crumpler, 1980) and in the region of Mt. Taylor (Perry et al., 1990). The xenoliths are variably strained and show evidence of complex histories, such as zoned plagioclase and clinopyroxene-rich websterites, olivine inclusions, and intergrowth. Some xenoliths show mesocratic reactions of olivine to clinopyroxene or, more rarely, to orthopyroxene + clinopyroxene. In addition to xenolith-bearing flows, there are aphyric and crystal-poor lavas on and near Mt. Taylor, and more evolved basalts that show evidence of complex histories, such as rounded plagioclase and clinopyroxene-phases and megacrysts.

Among the questions we are addressing:

• What are the chemical and thermal states of the mantle recorded by the basaltic xenoliths and basalt, and how did they change in time and space?
• Are multiple parental basalts (Si-saturated vs. undersaturated melts) required to explain the basaltic xenoliths?
• What was the chemical and thermal state of the mantle recorded by the basaltic xenoliths?

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Basalts

- Mantle xenoliths: X-plots bearing aphyric to crystal-poor basanites and alkali basalts (MT, MC, and RP)
- Moderately differentiated basaltic: More differentiated basaltic with plagioclase and clinopyroxene xenoliths (MT and MC)
- Basalts with textural evidence of crustal residuum: Hyl-Q-normative basalts with plagioclase + clinopyroxene megacrysts (MT and late at MC)

Xenoliths

We sampled xenoliths from Mount Taylor basalt flows and from the Santa Clara volcanic necks in the Rio Puerco volcanic field.

Mount Taylor

Spinel harzburgites have variably strained and garnetiferous textures, often in the same sample. Some xenoliths contain rounded diopside grains, often optically continuous, in a matrix of clinopyroxene. This texture is also common in xenoliths from other samples. Some xenoliths show the intergrowth of clinopyroxene and orthopyroxene and the xenoliths contain orthopyroxene replacing olivine.

Rio Puerco (Santa Clara)

• X-plots xenoliths are more homogeneous and show textures similar to the Mount Taylor xenoliths. The differences are the spinel lherzolites in some RP xenoliths show textures resembling pyroxenite reactions from garnet.

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