\textbf{40Ar/39Ar Ages of Challis Volcanic Rocks and the Initiation of Tertiary Sedimentary Basins in Southwestern Montana}^1

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\textbf{ABSTRACT}

\textsuperscript{40}Ar/\textsuperscript{39}Ar ages on single sanidine crystals from rhyolitic tuffs and ash flow tuffs within the uppermost and lowermost parts of the volcanic sequence of the Horse Prairie and Medicine Lodge topographic basins, southwestern Montana, show that these volcanic rocks were emplaced between about 48.8 \pm 0.2 Ma and 45.9 \pm 0.2 Ma, and are correlative with the Eocene Challis Volcanic Group of central Idaho. Sanidine ages on tuffs at the base of the Tertiary lacustrine, paludal, and fluvial sedimentary sequence, which unconformably overlies the volcanic sequence, suggest that sedimentation within an ancestral sedimentary basin that predated the development of the modern Horse Prairie and Medicine Lodge basins began in the middle Eocene.

\textbf{INTRODUCTION}

Single sanidine crystals separated from rhyolitic tuffs and ash flow tuffs in the Tertiary volcanic sequence of the western Horse Prairie and northern Medicine Lodge topographic basins of southwestern Montana (Fig. 1) were analyzed using a continuous laser, \textsuperscript{40}Ar/\textsuperscript{39}Ar dating system. Sanidine from tuffs at the base of the overlying post-volcanic Tertiary sedimentary sequence in the Medicine Lodge basin were also dated. The purposes for obtaining the radiometric ages were to determine the time represented by the volcanic sequence, to test the temporal correlation of this volcanic sequence with the Challis Volcanic Group of central Idaho, to check correlations of volcanic units within and between the basins, and to date the time of initiation of lacustrine-fluvial sedimentation in the ancestral Tertiary basin(s) in the absence of paleontologic age control for this important event.

\textbf{GEOLOGIC SETTING}

The Horse Prairie basin and the Medicine Lodge basin lie north of the Snake River Plain near the eastern border of the Cordilleran thrust belt, which overlaps the Archean craton. These two intermontane basins lie between the Beaverhead Mountains on the west and south and the Tendoy-Pioneer mountains on the east and north, and are separated by the Maiden Peak spur of the Beaverhead Mountains (Fig. 1). The basins cover an area of about 318 mi\textsuperscript{2} (825 km\textsuperscript{2}) and contain Eocene to Miocene volcanic and sedimentary rocks.

Basement rocks of the Maiden Peak spur are composed mainly of Archean granitoid gneiss locally overlain by Paleozoic and Cenozoic rocks. Basement rocks of the Tendoy Mountains and the Beaverhead Mountains are made up mainly of Archean gneiss overlain by Proterozoic, Paleozoic, and Mesozoic sedimentary rocks. The pre-Cenozoic rocks are distributed in several thrust plates, which are broken by younger low-angle and high-angle faults.

The volcanic sequence, which is exposed on the west and east sides of the Horse Prairie basin and the Medicine Lodge basin, is composed mainly of andesitic to basaltic lava flows, but also includes intercalated tuff-breccias and rhyolitic tuffs. These volcanic rocks were deposited on an erosion surface formed on rocks of the thrust terrain, and the thickness of the volcanic sequence differs from place to place. The sequence is absent across the southern part of the Maiden Peak spur and adjacent parts of the Tendoy Mountains, but present further south (Fig. 1). The absence may reflect non-deposition across a local basement high during volcanism, or subsequent uplift and erosion of the volcanic cover before deposition of the Tertiary basin sediments (M’Gonigle et al, 1991). The thickest exposures of the volcanic sequence are about 6,900 ft (2,100 m) in the western Horse Prairie basin, and about 4,300 ft (1,300 m) on the northeast side of the Maiden Peak spur (Staatz, 1972; M’Gonigle, unpublished mapping).

Tertiary beds in the western Horse Prairie basin, labeled T on Figure 1, are known to include a basal limestone (unit T1?, Fig. 2; Flores and M’Gonigle, 1991), but otherwise, as far as we