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THERMAL AND TECTONIC HISTORY IN THE STEAMBOAT HILLS GEOTHERMAL FIELD: DETERMINATION OF THE AGE OF ACTIVE HYDROTHERMAL ACTIVITY BY APPLICATION OF AFTA™ (APATITE FISSION TRACK ANALYSIS).

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ABSTRACT

This study, in the Steamboat Hills area of the Carson segment of the northern Walker Lane Belt, was initiated to provide a regional thermal history framework and to investigate the age of the active local hydrothermal system. Seven outcrop samples, representing ?Cretaceous granodiorite and ?Triassic Peavine sequence metamorphosed volcanic flow and volcaniclastic rocks plus six samples of Peavine rocks in vertical sequence from an 0.8 km deep geothermal corehole have been analyzed using AFTA (apatite fission track analysis) and zircon fission track analysis.

AFTA results from the outcrop samples indicate:

1. The rocks mapped as ?Cretaceous granodiorite are represented by at least two distinct phases: one, in the western Steamboat Hills, is Late Cretaceous or older (>~80 Ma); another, in the eastern Steamboat Hills, is Miocene (~22 to 16 Ma).

2. A major cooling period followed "Laramide" tectonism, with the older granodiorite and ?Triassic Peavine rocks cooling from peak paleotemperatures of >~100°C commencing at some time in the period ~90 to 60 Ma. The Miocene granodiorite cooled rapidly to 50°C suggesting emplacement at shallow depth.

AFTA results from the geothermal well indicate:

Hydrothermal activity (present thermal gradient in the well is ~250°C/km over 0.8 km) was initiated between 30,000 and 100,000 years BP. This suggests an average heating rate between 1° and 3°C per 1000 years. However, actual heating was probably much more rapid as hot fluids invaded contemporaneous fractures.

Integration of AFTA and zircon fission track data shows that the ?Triassic metamorphic rocks in the well cooled below ~300°C between ~90 and 80 Ma and below ~110°C by ~60 Ma. This thermal history is consistent with contact heating associated with local "Laramide" granodiorite intrusion (rather than regional metamorphism) followed by regional kilometer-scale uplift and erosion. The Miocene granodiorite is synchronous with other intrusions and volcanism in the Cenozoic magmatic arc of western Nevada and California.