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TITLE: Tephra Deposits in Lake Mead Miocene Sediments: Characteristics, Chronology, and Sources

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ABSTRACT BODY: The Lake Mead extensional domain, in the east central Basin and Range Province, contains Miocene basin sediments that have undergone complex faulting and deformation. A rich tephra record in the basin sediments provides a chronological and correlation framework that can help understand the depositional and deformational processes during Miocene and post-Miocene time. The tephra layers, up to 10s of cm thick, range from white deposits containing glassy shards to bright green layers in which all original glass has been altered to the zeolite mordenite. The tephra layers range from aphyric to extremely crystal rich. Many appear to be primary ashfall deposits based on depositional geometry, uniform crystal size, and good preservation of glass or relict glass shard structures. However, some layers show evidence of reworking as evidenced by variable crystal size, and the presence of plutonic feldspar and rock fragments. Electron microprobe analyses of preserved glass reveal that compositions of almost all of the tephra layers are high silica rhyolite, typically with FeO and CaO contents of 1wt% or lower. Where present, the glass in the tephra layers is invariably hydrated, consistent with their age, but although the alkali concentrations in the glass are likely to have been modified by the hydration process, other elements, particularly Fe, Ca, Ti, and Cl appear to yield robust concentrations. The compositions of individual layers with respect to these elements are very homogeneous, based on analysis of 20-30 glass shards per sample, and can be used to correlate individual tephra layers between different parts of the sedimentary basin, although a number of layers have very similar compositions. Some higher Fe rhyolites/dacites (up to 4 wt.% FeO) are also observed. Crystal-bearing tephra layers contain some combination of quartz, one or two feldspars (typically a chemically uniform sanidine and a range of plagioclase compositions), biotite, amphibole, and magnetite. Variation is observed in the crystal size (close to 1 mm down to 10 um) and content (close to 50% to aphyric) of different tephra layers. For correlation of tephra layers with no glass, precisely measured K content of sanidine, along with the range of Ba concentration has proved to be most useful, although this criteria is more robust when suggesting non-correlations, because there appear to be instances where different eruptions have identical sanidine composition. 40Ar/39Ar age determinations on sanidine crystals reveal a large age range in tephra layers from the Lake Mead sedimentary basin, with the oldest tephra erupted at 22.88±0.02 Ma and the youngest at 12.93±0.02. Other tephra have ages of 13.20±0.04, 13.43±0.02, 14.20±0.05, 14.62±0.01, 15.09±0.02, 15.35±0.06, 15.67±0.07, 16.29±0.11, and 18.41±0.04. The chronology, geochemistry and coarse grain size of many of the tephra layers suggest derivation from either the Southwest Nevada Volcanic Field or the Caliente Caldera area. The tephra erupted at 12.93±0.02 is chronologically and geochemically similar to the very large Topopah Tuff eruption, and the 18.41±0.04 tephra may be related to the Caliente Caldera Hiko Canyon/Racer Canyon events. However, a set of finer grained, Fe-rich and/or anorthoclase-bearing tephra layers may have been erupted further afield, likely being related to Miocene Yellowstone plume track volcanism.

KEYWORDS: 8455 VOLCANOLOGY Tephrochronology, 1135 GEOCHRONOLOGY Correlative geochronology, 1145 GEOCHRONOLOGY Tephrochronology.

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