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D.C. Noble, E.H. McKee, and L.T. Larson

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LATE MIOCENE HYDROTHERMAL ACTIVITY AT THE WILLARD AND SCOSSA MINING DISTRICTS, PERSHING COUNTY, NORTHWESTERN NEVADA

DONALD C. NOBLE — *Mackay School of Mines, University of Nevada-Reno, Reno, NV 89557*
EDWIN H. McKEE — *U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025*
LAWRENCE T. LARSON — *Mackay School of Mines, University of Nevada-Reno, Reno, NV 89557*

Willard and Scossa are relatively minor epithermal precious-metal districts in northwestern Nevada. We present new radiometric ages that indicate a late Miocene age (6.1 ± 0.3 and 6.5 ± 0.2 m.y., respectively) for hydrothermal activity in both districts.

The Willard district in south-central Pershing County is located along the western margin of the Humboldt and West Humboldt Ranges. Production has been mainly precious metals and antimony (Johnson, 1977; Lawrence, 1963; Muto, 1980). Most of the mineral deposits in the Humboldt Range are of Mesozoic or Paleogene age (Vikre and McKee, 1985). The presence of an active high-temperature geothermal system at Florida Canyon (Humboldt Station), however, has led to the speculation that mineralization at Florida Canyon, and perhaps other districts along the western margin of the range, took place during latest Cenozoic time. The age of 6.1 ± 0.3 m.y. (sample 1) obtained on adularia from a vuggy quartz-adularia vein demonstrates latest Miocene hydrothermal activity at Willard. Although such quartz-adularia veins are common and widespread at Willard, gold may be more closely associated with silicified zones (jasperoid) in clastic and carbonate rocks of the Mesozoic Auld Lang Syne Group. The possibility therefore exists that mineralization may in part or entirely be related to one or more periods of hydrothermal activity older than 6.1 ± 0.3 m.y.

The Scossa district in northwestern Pershing County has produced gold and silver, mainly during the 1930's (Johnson, 1977; Robbins, 1985) and some mercury in the 1950's. The alunite sample dated at 6.5 ± 0.2 m.y. (sample 2) was collected from one of several steeply-dipping N–S trending enechelon veins approximately 0.5 m thick hosted by tilted fanglomerate of Tertiary age. The veins locally contain breccia fragments of silicified fanglomerate cemented by cockscomb quartz. Analyses of more than 70 samples taken from this and other veins in the immediate area range to as much as 0.082 oz/ton Au, 22 oz/ton Ag, 400 ppm As, and 3.6 ppm Hg. The vein dated is located about 1.5 miles west of the main part of the Scossa district, where N–S trending veins are hosted by clastic strata of Mesozoic age.

The ages of 6.1 ± 0.3 and 6.5 ± 0.2 m.y. demonstrate hydrothermal activity at Willard and Scossa during late Miocene time. Because these are two of the youngest fossil hydrothermal systems recognized in Nevada, it is desirable to consider their origin in light of present knowledge of the space-time distribution of magmatic and tectonic activity in the Great Basin during Neogene time.

A major pulse of bimodal basalt-rhyolite volcanism took place in the northwestern and northern Great Basin during middle Miocene time, peaking about 15.5 m.y. ago (Noble and others, 1970; McKee and Noble, 1986), and a number of epithermal mineral deposits were formed during this time (Silberman, 1985; Harvey and others, 1986; Noble and others, 1987). Major crustal extension and high-angle basin and range faulting also began in the middle Miocene (e.g., McKee and Noble, 1986). Although basalt was erupted during latest Miocene and Pliocene time in northwestern Nevada (Luedke and Smith, 1981), mafic intrusive bodies are in general not of the appropriate size and shape to provide the heat required to drive a major hydrothermal convective system. Bodies of silicic magma are ideal heat sources to produce a hydrothermal system (Smith and Shaw, 1975). However, silicic rocks of late Miocene and younger age are found mostly along the margins of the Great Basin. Hydrothermal activity at Willard and Scossa, as well as at very young districts such as Sulfur in southwestern Humboldt County (Wallace, 1980), which is about 2 m.y. old (Silberman, 1985), McGinnis in southern Lander County, about 2.5 m.y. old (Wendell, 1985; Casaceli and others, 1986), and probably Florida Canyon in central Pershing County, was therefore probably related to high regional heat flow and deep conductive heating of groundwater in systems similar to the present-day high-temperature geothermal systems of the northern part of the Great Basin (Benoit and Butler, 1983; Blackwell, 1983; Mariner and others, 1983).

SAMPLE DESCRIPTIONS

1. *WILLARD* K-Ar
Coarse vein adularia (from mine dump; SE/4 SE/4 S26,T28N,R32E; Pershing Co., NV) associated with quartz. *Analytical data:* K_2O = 15.60 wt %; $^{40}Ar^*$ = 1.3637 × 10^{-10}; $^{40}Ar^*/\Sigma^{40}Ar^*$ = 44.9%. *Collected by:* D. C. Noble and L. T. Larson.
(adularia) 6.1 ± 0.3 m.y.

2. *SCO-AL* K-Ar
Fine-grained yellow vein material (from surface exposure; W/2 W/2 S9,T33N,R30E; Pershing Co., NV) consisting largely of alunite. *Analytical data:* K_2O = 9.45 wt. %; $^{40}Ar^*$ = 8.8978 × 10^{-11}; $^{40}Ar^*/\Sigma^{40}Ar^*$ = 24.5%. *Collected by:* D. C. Noble and L. T. Larson. *Comment:* Alunite-rich bands are an integral part of the vein structure and, although fine grained, the alunite appears to be hypogene.
(alunite) 6.5 ± 0.2 m.y.

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