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ANOMALOUS PLATINUM ASSOCIATED WITH HYDROTHERMAL  
MANGANESE MINERALIZATION AT THE GIBELLINI MINE,  
FISH CREEK RANGE, NEVADA

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This information should be considered preliminary.  
It has not been edited or checked for completeness  
or accuracy.

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## INTRODUCTION

Hydrothermal platinum-group metal (PGM) mineralization is known from many parts of the world (Kemp, 1902). These occurrences are usually associated spatially with favorable source rocks having elevated background concentrations of labile (i.e. contained within sulfides or sulfosalts) platinoids (Lechler and Hsu, in preparation). Source rocks typically are mafic to ultramafic igneous or metamorphic rocks of Precambrian age. The current state of knowledge concerning these deposits indicates limited transport distances for the metals in that the inferred source rocks also serve as host rocks in many occurrences. This suggests that readily identifiable, favorable source rocks should occur proximally to known hydrothermal PGM mineralization, and this is overwhelmingly the case. Platinum mineralization identified at the Gibellini manganese deposit is hosted by Devonian Devils Gate Limestone and no mafic rocks are known in the area, making this a very unusual deposit.

## GEOLOGY AND GEOCHEMISTRY

The Gibellini mineralization occurs within 300 m of an allochthonous block of Devonian Woodruff Formation rocks which contain syngenetic concentrations of vanadium exceeding 4000 ppm, nickel over 1300 ppm, and zinc over 18,000 ppm (Desborough and others, 1984). Metalliferous black shales

contain approximately 1000 ppm manganese (Vine and Tourtelot, 1970) and tens of ppb platinum (Lechler, unpub. data). The Woodruff mudstones contain up to 30 ppb platinum which is 1 to 3 orders of magnitude higher than the platinum content of most unmineralized crustal rocks, making the Woodruff an attractive potential source rock for the platinum found at Gibellini. It is proposed, therefore, that the platinum found in the Gibellini manganese ore could have been leached from the Woodruff Formation by hydrothermal solutions. In support of this proposition is the vanadium-nickel-zinc mineralization which accompanies manganese at Gibellini. Hydrothermal PGM mineralization associated with mafic-ultramafic rocks exhibits accompanying copper or copper-nickel(cobalt) mineralization. The vanadium-nickel-zinc geochemical signature at Gibellini is suggestive of metal redistribution from a black shale source.

Platinum concentrations exceeding 600 ppb have been found in the Gibellini manganese-vanadium-nickel-zinc ore. Sample location descriptions and analytical results are shown in table 1. Platinum-palladium ratios at Gibellini are quite high for a hydrothermal PGM deposit (exceeding 10:1) and rhodium abundances are approximately equal to those of palladium. Palladium concentrations are typically equal to, or greater than, the platinum (or other platinoid) concentrations in hydrothermal PGM deposits. This has been explained by the higher solubility of palladium relative to

the other platinoids in hydrothermal solutions. Rhodium abundances are generally an order of magnitude lower than those of platinum or palladium in hydrothermal deposits and neither platinum nor rhodium suffers supergene modification to the extent that palladium does (McCallum and others, 1976). In general, rhodium and palladium concentrations at Gibellini are approximately an order of magnitude less than those of platinum, indicating significant supergene leaching of palladium. Palladium is not known to re-precipitate at depth, forming enrichment layers, as do copper and silver, and it generally leaves the system entirely. Palladium concentrations in primary, unweathered Gibellini ore may be expected to equal or exceed the platinum concentrations found in outcrop.

The Gibellini PGM deposit represents the only known hydrothermal platinoid mineralization of its type (i.e. black shale affinity) in Nevada, and perhaps the world. The European Kupferscheifer/Zechstein deposit is a possible exception, although it differs in many ways from the Gibellini occurrence. Seven other manganese ores from Nevada and one from New Mexico (see table 2) were also analyzed for their PGM contents to test the pervasiveness of the manganese-platinum association. None of these other manganese-bearing samples exhibited platinum or palladium abundances in excess of 10 ppb. The Gibellini PGM occurrence is unique among the manganese ores tested.

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Table 1. Sample locations and PGM concentrations (in ppb) of samples taken from the main workings of the Gibellini Mine, SE 1/4 SW 1/4 SW 1/4 sec. 35, T16N, R52E, Eureka County.

Sample Location	Pt	Pd	Rh
L1: High grade manganese ore taken from adit wall on lower level.	324	23	27
M1: High grade manganese ore taken from shaft wall on middle level.	178	23	37
M2: High grade manganese ore taken from inside left entrance to stope on middle level.	626	45	16
M3: High grade manganese ore taken from inside right entrance to stope on middle level.	300	26	27
U1: Medium grade manganese ore taken adjacent to fault contact on upper level of workings.	63	16	24
U2: High grade manganese ore taken from outcrop 3 m to right of incline entrance on upper level.	489	36	29
U3: High grade manganese ore taken from outcrop 10 m to right of incline entrance on upper level.	167	18	27
I1: Low grade vein material taken from incline wall 20 m down incline (upper level).	<10	9	<10
LV: Sample of thin, weakly mineralized vein approximately 5 m above upper level incline entrance and main mineralized zone.	11	5	<10

(PGM's determined by fire assay/graphite furnace AAS)

Table 2. Locations of manganese ore samples analyzed for platinum and palladium as a comparison with the Gibellini Mineralization. All samples contained less than 10 ppb Pt and Pd.

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Sample	Locality
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New Mexico

Luis Lopez: Sec. 7&8, T4S, R1W., NM Principal Meridian

Nevada

Golconda: Sec. 1, T35N, R40E, and sec. 36, T36N, R40E,  
Humboldt County

Victory: Sec. 7, T34N, R40E, Humboldt County

Black Diablo: Sec. 2, T32N, R39E, Pershing County

Ben Clark: Contact Mining District, Elko County

MG Clark: Contact Mining District, Elko County

Dry Hills: Sec. 10, T39N, R42E, Humboldt County

Buffalo Mtn.: Sec. 8, T33N, R41E, Humboldt County