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MINES BRANCH INVESTIGATION REPORT IR 62-86

**A MINERALOGICAL REPORT ON A GOLD
ORE FROM MADSEN RED LAKE GOLD
MINES LTD., MADSEN, ONTARIO**

by

M. R. HUGHSON & S. KAIMAN

EXTRACTION METALLURGY DIVISION

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A MINERALOGICAL REPORT ON A GOLD ORE FROM
MADSEN RED LAKE GOLD MINES LTD., MADSEN, ONTARIO

by

M. R. Hughson* and S. Kaiman**

SUMMARY

Very fine particles of native gold, approximately 4 or 5 microns in size, occur in the non-opaque minerals. A small proportion of the gold particles are partially or completely enclosed by magnetite and the sulphides pyrite, pyrrhotite and chalcopyrite. No particles of native gold were observed associated with the arsenopyrite.

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INTRODUCTION

A sample of minus 1/2 inch mill feed was submitted by Madsen Red Lake Gold Mines Ltd., Madsen, Ontario, to the Extraction Metallurgy Division on July 30, 1962. It was given our Reference No. 7/62-10. About one pound of the ore was taken, washed through a 10 mesh screen and the plus 10 mesh material retained for the mineralogical investigation. The purpose of this investigation was to study the occurrence of the sulphide minerals and of gold.

Fire assays and chemical analyses of a head sample gave the following results: 0.276 oz Au/ton, 1.59 per cent CO₂ (evolution), 0.40 per cent As, 8.76 per cent Fe, 2.02 per cent S, and 0.0045 per cent Sb. No tellurium was detected.

The sample was first examined under a low power binocular microscope. Polished sections of twenty-four rock chips, selected because they contained concentrations of metallic minerals, were then traversed with the ore microscope. In addition, six thin sections of rock chips were studied with a petrographic microscope to investigate the non-opaque minerals. All mineral identifications were confirmed by X-ray diffraction methods.

MINERALOGY

The ore consists of a light greenish grey to black, fine-grained siliceous rock containing minor amounts of calcite. The most abundant constituents are quartz and sericite. In addition to calcite the minor minerals include sphene, amphibole, garnet, magnetite, sulphides and native gold.

The most abundant non-opaque mineral, quartz, occurs as white anhedral grains. Interspersed in varying density among the quartz grains are pale brown to pale green plates and laths of sericite. Occasionally the sericite appears to be fibrous and may form dense bands several millimetres in width. White anhedral grains of sphene are disseminated in the rock. Less common are white subhedral grains of garnet, emerald green anhedral grains of amphibole and white anhedral grains of calcite.

Fine-grained, anhedral magnetite is locally abundant, commonly in the vicinity of pyrrhotite or arsenopyrite. Magnetite may also form minute veinlets and may rim the sulphide minerals or be intergrown with them.

Pyrite and pyrrhotite are the most abundant sulphide minerals. Minor sulphides are arsenopyrite and chalcopyrite. Pyrite is present in varying proportions but was observed in most of the rock chips examined. It occurs as fine-grained and rarely as medium-grained, subhedral to anhedral, randomly disseminated grains which in many places are segregated into wavy or discontinuous bands. The occurrence of pyrrhotite is similar although like magnetite it is only locally abundant. In one specimen, however, it occurs as massive bands several millimetres thick. Arsenopyrite is much less common than either pyrite or pyrrhotite and usually is found in the form of euhedral to subhedral crystals. Chalcopyrite is very scarce.

Native gold was observed in three of the twenty-four rock chips examined. Thirty-three particles of native gold were found in one rock chip and two each in the other two. Twenty-three particles of native gold occur in non-opaque minerals (Figure 1), three are enclosed in grains of pyrite (Figure 2), one is enclosed in a grain of pyrrhotite, two are attached to grains of magnetite, one is attached to a grain of pyrrhotite and seven occur in a veinlet with magnetite and chalcopyrite. Two particles of native gold are unusual in that they appear to show crystal outline (Figure 3). The average observed dimension of the majority of the gold particles is about 4 or 5 microns. The smallest particle measured 2 by 3 microns and the largest 19 by 26 microns. The width of the veinlet containing native gold varies considerably but is in the neighbourhood of 20 microns.

PHOTOMICROGRAPHS

Photomicrographs of polished sections of rock chips illustrating the occurrence of gold. The line drawn on each photomicrograph represents 10 microns.

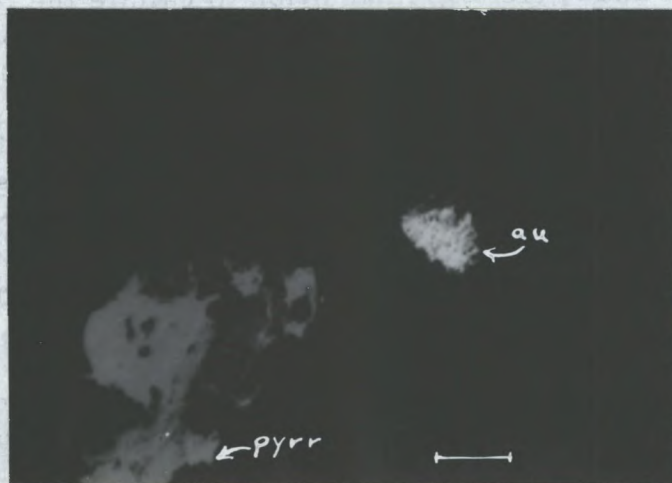


Figure 1. A grain of native gold (au) in non-opaque gangue minerals. Pyrrhotite (pyrr) occurs nearby. X1000

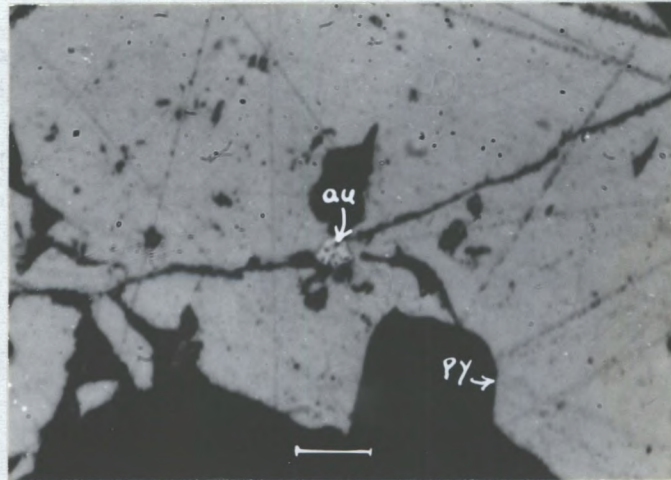


Figure 2. A particle of native gold (au) enclosed in a grain of pyrite (py). The dark areas are non-opaque gangue minerals. X1000

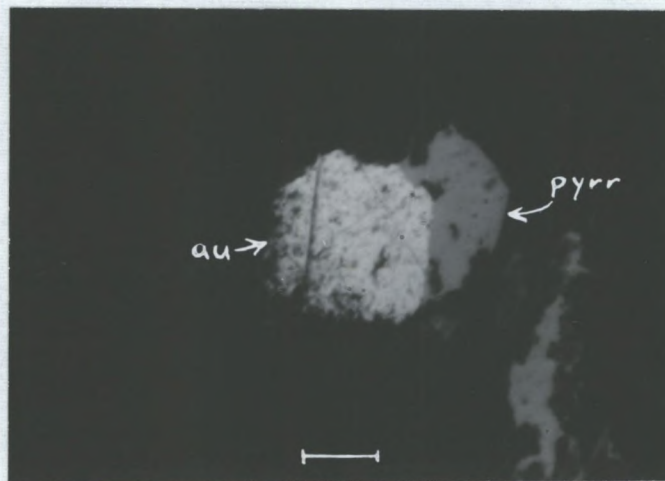


Figure 3. A grain consisting of native gold (au) and pyrrhotite (pyrr) in non-opaque gangue minerals. The gold appears to show crystal form. X1000

CONCLUSIONS

Four sulphide minerals, pyrite, pyrrhotite, arsenopyrite and chalcopyrite, were identified in an ore sample from Madsen Red Lake Gold Mines Ltd. Pyrite and pyrrhotite are much more abundant than arsenopyrite and chalcopyrite. The sulphides occur as disseminated grains either randomly distributed or segregated into bands of varying density. Only pyrrhotite was observed in massive seams.

Gold occurs as the native element, usually as minute particles in non-opaque minerals. In a few places particles of native gold are surrounded by or attached to grains of other metallic minerals, including pyrite, pyrrhotite, chalcopyrite and magnetite. No visible gold is associated with arsenopyrite. Most of the gold particles average about 4 to 5 microns in size.

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