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MINERALOGICAL EXAMINATION OF FOUR SAMPLES OF GOLD ORE FROM SURLUGA GOLD MINES LIMITED, WAWA, ONTARIO

by

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MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

The mineralogy of four samples of gold ore from the Surluga Gold Mines Limited deposit near Wawa, Ontario, has been investigated. The results show that the samples are all mineralogically similar. The principal metallic minerals in the ore are pyrite and pyrrhotite. Both occur as grains disseminated in gangue, although pyrrhotite also occurs as small masses. The native gold was found as inclusions in gangue and as inclusions in, and as small particles in intimate association with, pyrite, arsenopyrite and pyrrhotite. Other minerals found in the samples include, native silver, stephanite, pentlandite, ilmenite, sphene, rutile, chalcopyrite, marcasite, sphalerite, galena, hematite, spinel, quartz, mica, chlorite, tourmaline, calcite and zircon.

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INTRODUCTION

Four samples of gold ore were received from Mr. R. W. Bruce of the Mineral Processing Division over a period extending from August 2 to September 18, 1967. Mr. Bruce requested that each sample be examined to determine the occurrence and grain size of the gold in the ore. The ore was reported to be from a deposit near Wawa, Ontario, and had been submitted to the Mines Branch by Surluga Gold Mines Limited, Ontario.

SAMPLES

The samples, as received, were labelled A-1, B-1, A-2 and B-2, and were reported to contain gold values from about 0.1 to 0.2 ounces per ton. The first two samples, A-1 and B-1, consisted of both hand specimens and a head sample, while the last two samples, A-2 and B-2 each consisted only of about 100 grams of head sample. The hand specimens of samples A-1 and B-2 were composed mainly of a tourmaline-mica schist containing disseminated metallic minerals. The head samples were each composed of material crushed to -10 mesh.

METHOD OF INVESTIGATION

The hand specimens of samples A-1 and B-1 were examined under the binocular microscope, the those showing the most mineralization were selected for polished sections, whereas some of the more poorly mineralized pieces were used to prepare thin sections. Each of the four head samples was screened, and the -48 + 270-mesh sizes were removed. These were then separated into sink and float sub-fractions by means of heavy liquids. The float sub-fractions were run on the X-ray diffractometer to determine the principal gangue constituents, while polished sections were prepared from both the float and sink sub-fractions for microscopic investigation. The minerals in the four ore samples were identified by microscopical and X-ray diffraction studies.

RESULTS OF INVESTIGATION

General Mineralogy of the Ore Samples

The four samples are very similar mineralogically, and the only major difference found was in the amount of ilmenite, which although much less abundent than pyrite or pyrrhotite, forms a major constituent of one of the samples. Native gold was found in all four samples as either inclusions in gangue or in association with some of the sulphide minerals. The remaining metallic minerals occur in small amounts, in some cases only as one or two grains.

Detailed Mineralogy

Occurrence of the Native Gold

As mentioned earlier in the report, native gold was found in all of the ore samples submitted for mineralogical examination. The association of the gold with the other minerals is determined chiefly from a study of samples A-1 and B-1, since uncrushed material was available only from these samples. However, comparison of all four crushed head samples indicated that the conclusions can be applied to all of them.

The native gold in the ore was found as inclusions in pyrite (Figure 1), gangue (Figures 2, 3 and 4), arsenopyrite (Figure 5) and pyrrhotite. In addition, it occurs as combined grains with pyrite in gangue (Figure 2) and as grains bordering on pyrite, pyrrhotite and arsenopyrite (Figures 1, 3, 4 and 5). The native gold is quite fine-grained, mostly in a size range of 5 to 30 microns. The largest grain observed was about 170 microns in diameter (sample B-1, Figure 6), whereas the smallest grains were of the order of 1 micron.

Other Minerals in the Ore Samples

Pyrite and Pyrrhotite

As was previously mentioned, pyrite and pyrrhotite are the two major metallic minerals found in the ore samples. In the polished sections of the hand specimens A-1 and B-1, it was found that the pyrite and pyrrhotite both occur as disseminated grains in gangue. In addition, the pyrrhotite also occurs as small masses in gangue. The grains of pyrite and pyrrhotite are similar in size, and vary from about 5 microns to 2 millimetres. The few small masses of pyrrhotite found range up to one centimetre in diameter. The inclusions in pyrite and pyrrhotite are few and, when present, each forms the majority of the inclusions in the other. In addition to this, the pyrite and pyrrhotite contain a few inclusions of native gold, chalcopyrite and gangue. The pyrrhotite also contains a few inclusions of pendlandite. These inclusions are quite small and in general do not exceed 75 microns in diameter.

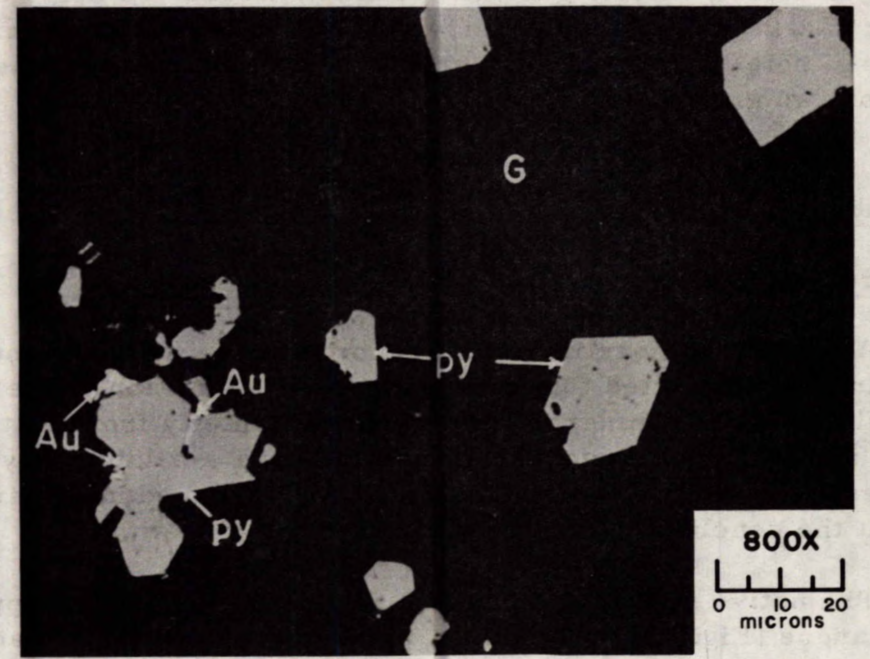

Figure 1. Photomicrograph (in oil immersion) of a polished section of hand specimen A-1 showing pyrite (py) grains in gangue (G). Minute particles of native gold (Au) are shown penetrating and adhering to one grain of pyrite.

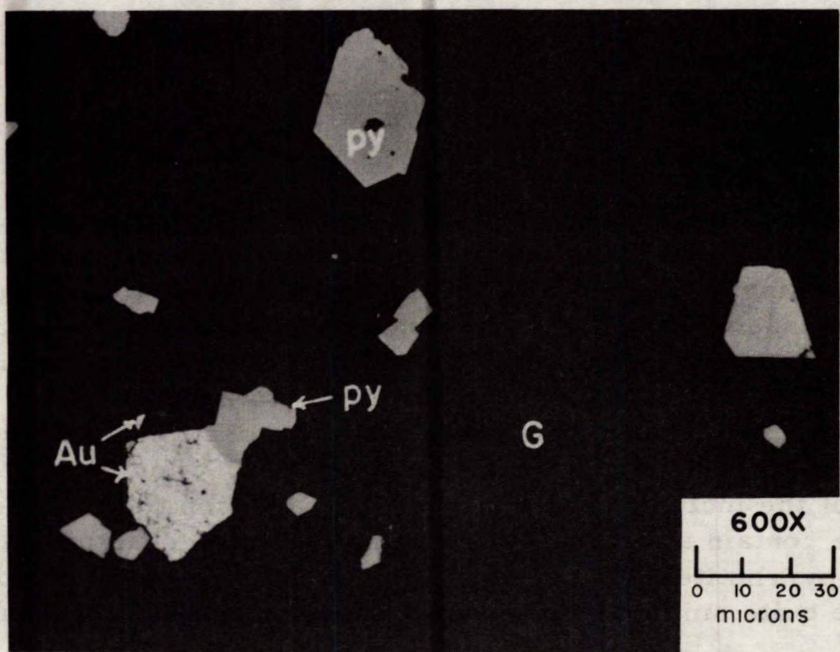

Figure 2. Photomicrograph (in oil immersion) of a polished section of hand specimen A-1 showing a combined grain of pyrite (py) and native gold (Au) in gangue (G). A very small inclusion of native gold in gangue can also be seen.

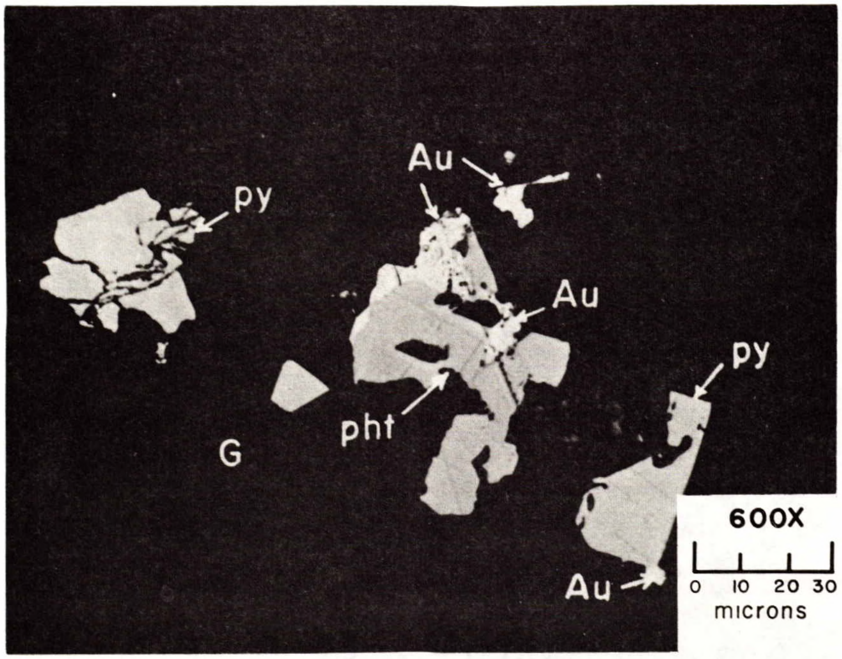

Figure 3. Photomicrograph (in oil immersion) of a polished section of hand specimen A-1 showing native gold (Au) and pyrrhotite (pht) combined in gangue (G). One grain of native gold is also shown as an inclusion in gangue, and another adhering to a grain of pyrite (py).

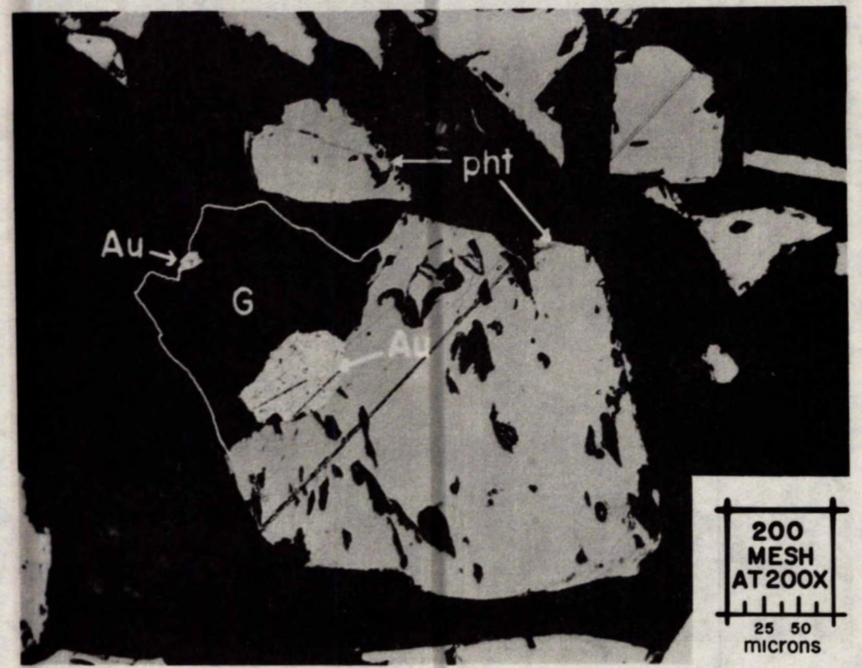

Figure 4. Photomicrograph of a polished section of head sample B-2 showing a number of pyrrhotite grains (pht), one of which is combined with a smaller grain of gangue (G). The gangue has been outlined in white to distinguish it from the mounting medium (black). One grain of native gold (Au) is shown at the edge of the gangue, and another at the contact between the pyrrhotite and gangue.

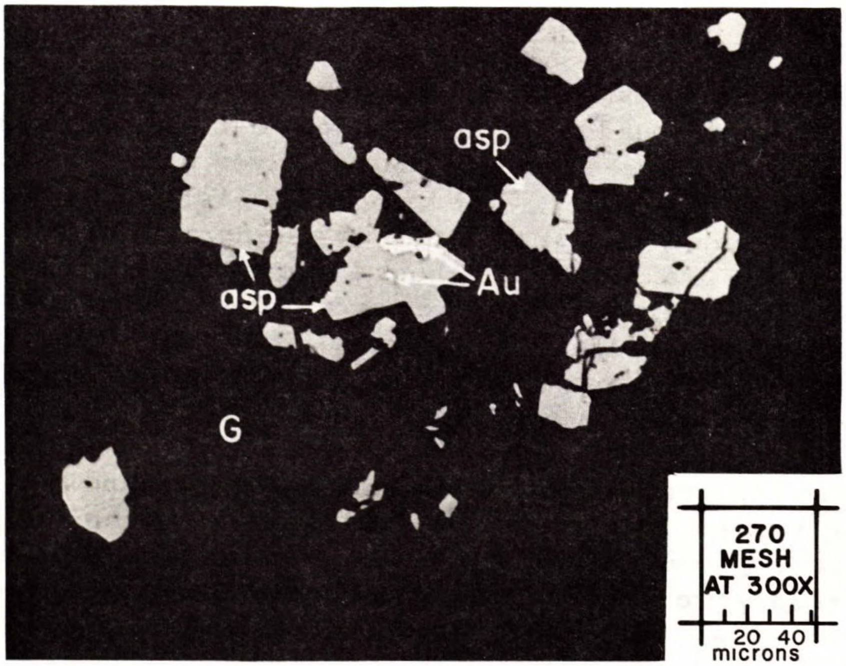

Figure 5. Photomicrograph of a polished section of head sample A-2 showing a number of small arsenopyrite grains (asp) in a large grain of gangue (G). One of the arsenopyrite grains contains a very small inclusion of native gold (Au) as well as a larger grain along contact of the arsenopyrite with the gangue.

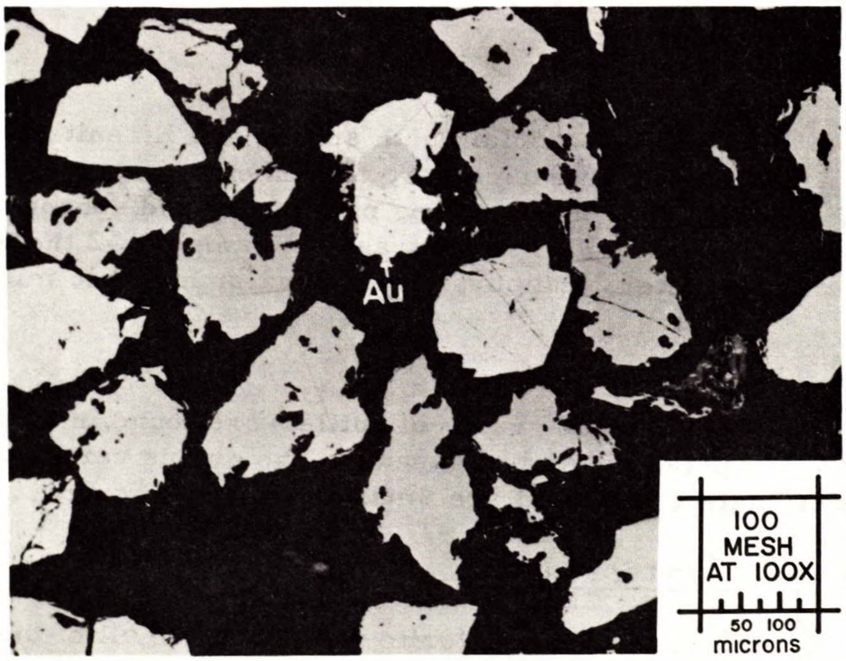

Figure 6. Photomicrograph (in oil immersion) of a polished section of head sample B-1 showing a relatively large grain of native gold (Au) containing an inclusion of pyrite. The other grains shown are of pyrite and pyrrhotite in about equal amounts.

Native Silver and Stephanite

Although no native silver was visible in either samples A-1 or B-1, two grains were found in the head sample B-2 and one grain in the head sample A-2. All three grains of native silver were free and average about 100 microns in diameter. The one grain in sample A-2 was found to contain a few extremely small inclusions of a mineral tentatively identified as stephanite. The grains average about 4 microns in size and are therefore too small to be positively identified; however, their colour and optical properties are similar to those of stephanite.

Arsenopyrite

A very small amount of arsenopyrite was found in the samples. In the hand specimens it was found as small generally euhedral grains in gangue, averaging about 50 microns in size. In the head sample A-2 one grain of arsenopyrite was found associated with native gold (Figure 5).

Pentlandite

In each of the four samples a number of grains of pyrrhotite were observed to contain small flame-like inclusions of what is believed to be pentlandite. These inclusions are small, and range from about 8 to 30 microns in size. This identification could not be substantiated by X-ray diffraction studies but the occurrence, form, and optical properties of the inclusions are all indicative of pentlandite.

Ilmenite and Sphene

All the samples contain both sphene and ilmenite. They occur in intimate association with each other, the ilmenite generally being partially replaced by sphene. Only a few grains of ilmenite and sphene were found in samples A-1, B-1 and B-2. In contrast, in sample A-2 the amount of ilmenite is much greater, and constitutes a major metallic mineral.

Rutile

Fairly numerous grains of rutile were found in all samples, where they occur disseminated in gangue. The grains vary from 5 to 150 microns in diameter, but most are smaller than 50 microns.

Chalcopyrite and Sphalerite

Chalcopyrite and sphalerite were found in all of the ore samples. The quantity of each was quite small, with sphalerite being much the lesser of the two. The chalcopyrite occurs as inclusions in gangue, pyrrhotite and pyrite. These grains are small, and range from about 5 to 60 microns in size, with the majority averaging about 20 microns. The sphalerite also was found as inclusions in gangue. Only a very few grains, averaging about 40 microns in size, were found in the ore.

Marcasite, Hematite, Spinel and Galena

No marcasite, hematite, spinel or galena were seen in the polished sections of the hand specimens of samples A-1 and B-1. A few grains of marcasite, however, were found in each of the four head samples. Two or three grains of hematite were found in each of the head samples except for sample B-2. These grains each contained small lamellae of ilmenite. Only a few grains of each of spinel and galena were found in all of the head samples, and these may be the result of contamination of the head samples during the milling process.

The gangue, in hand specimen, was found to consist largely of a tourmaline-mica schist. The minerals comprising the gangue are quartz, mica, chlorite, tourmaline, calcite and zircon.

CONCLUSIONS

From the microscopical studies of the four samples a number of conclusions can be drawn. Firstly, the native gold is generally very fine-grained, with many of the particles less than 20 microns in diameter, and it is to be expected that most of the gold will not be liberated by normal grinding. Secondly, a number of the grains of native gold in the ore occur at the contact between two minerals, as shown in Figures 1, 3, 4 and 5. It is to be expected that upon grinding and crushing some of the grains of native gold will adhere to the edges of these grains, and thus be accessible to cyanidation. This feature was found in a few instances in the examination of the head samples, although not in the majority of cases. However, the number of grains of gold observed was only 46, which is probably too small a number to be statistically significant.