Dr. J. Convey

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 63-12

A MINERALOGICAL REPORT ON A DIAMOND DRILL CORE SAMPLE FROM PHELPS DODGE CORPORATION OF CANADA LTD., TORONTO, ONTARIO

by

M. R. HUGHSON & S. KAIMAN

EXTRACTION METALLURGY DIVISION

4P

NOTE: THIS REPORT RELATES ESSENTIALLY TO THE SAMPLES AS RECEIVED. THE REPORT AND ANY CORRESPONDENCE CONNECTED THEREWITH SHALL NOT BE USED IN FULL OR IN PART AS PUBLICITY OR ADVERTISING MATTER.

COPY NO. 4

FEBRUARY 18, 1963

Industrial Confidential

Mines Branch Investigation Report IR 63-12

A MINERALOGICAL REPORT ON A DIAMOND DRILL CORE SAMPLE FROM PHELPS DODGE CORPORATION OF CANADA LTD., TORONTO, ONTARIO

by

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

SUMMARY

Fine grained galena is uniformly disseminated throughout a light grey calcareous sandstone. A small proportion of coal is present as lenses, nodules, and seams up to several centimetres in thickness. Sulphide minerals, particularly pyrite, are concentrated in and around the coarser coal inclusions.

---

*Scientific Officer and **Head, Mineralogy Section, Extraction Metallurgy Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

A 16 lb sample of diamond drill core was submitted by the Phelps Dodge Corporation of Canada Ltd., 55 Yonge St., Toronto 1, Ontario to the Extraction Metallurgy Division of the Mines Branch on November 28, 1962 and was given our Reference No. 11/62-14. The sample was reported to be from the basin area of the Salmon River in Cape Breton Island. The Mineralogy Section was requested to determine the minerals present in the sample and the nature of their occurrence. Special attention was to be given to a search for barite because it was thought that the presence of barium might account for inconsistencies occurring in chemical analyses for lead.

METHOD OF INVESTIGATION

Before commencing the mineralogical investigation a representative head sample was prepared for analysis. Part of the sample was submitted for chemical analysis for Pb, Fe, Ba, CO_2 (evolution) and CO_2 (combustion). The Pb analyses were to be carried out by several different methods to determine whether these methods yielded reproducible results. The results of the lead analyses will be reported on at a later date by the Control Analysis Section. Another part of the representative sample was submitted for semi-quantitative spectrographic analysis.

The mineralogical investigation consisted of a preliminary examination of specimens of the drill core with a low power stereoscopic microscope, a study of seven rock thin sections with a petrographic microscope, and a study of fifteen polished sections with an ore microscope. The identification of all minerals was confirmed by X-ray diffraction methods.

RESULTS OF INVESTIGATION

Analyses

The results of a semi-quantitative spectrographic analysis of a representative sample of drill core are given in Table 1.

TABLE 1

Semi-Quantitative Spectrographic Analysis*

Element	Per Cent	Element	Per Cent
Si	Principal Constituent	Ba	0.4
Ca	6	Zr	0.06
Pb	4	Nb	0.03
Al	3	Mo	0.03
Fe	2	Ni	0.01
Mg	1	Ca	0.007
Zn	0.7	V	0.006
Mn	0.5	Cr	0.004
Ti	0.5	Ag	Trace

*Report No. SL62-314, Spectrographic Laboratory, Mineral Sciences Division.

Chemical analyses gave the results shown in Table 2.

TABLE 2

Chemical Analyses†

Element	Per Cent
Pb	2.65
Ba	0.2
Fe	2.30
CO_2 (combustion)	7.45
CO_2 (evolution)	4.65

†Report No. EM3006, Control Analysis Section, Extraction Metallurgy Division.

The elemental carbon content as calculated from the above CO_2 analyses is 0.8 per cent.

Mineralogy

The sample is composed of a quartz-carbonate rock which contains galena, pyrite and other sulphides and occasional lenses, seams and nodules of coal.

The rock is fine grained, light grey, soft and friable. It is believed to be a calcareous sandstone composed of subhedral to anhedral, fine grained quartz cemented by calcite. Minor proportions of chlorite are intergrown with the calcite. Here and there among the quartz grains are grains of feldspar, barite and a spinel. Small nodules of kaolinite occur in some specimens.

A few very fine grained specimens show distinct banding. The darker bands are enriched in chlorite and also contain sericite. Several specimens which appear to be conglomeritic are comprised of rounded masses or pebbles of very fine grained quartz and calcite surrounded by a matrix of coarser grained quartz and calcite.

Lenses, nodules and seams of a soft, friable, black coal comprise a minor proportion of the sandstone (elemental carbon=0.8 per cent). The coal has a specific gravity of about 1.3. It burns at a dull red heat leaving a light grey ash. The colour of the coal is predominantly dull black or shiny black on freshly fractured surfaces. A small proportion is dark brown. The lenses and nodules are up to several centimetres in width but the seams are seldom over one or two millimetres thick. Evidence of the original cellular plant texture is often seen on broken surfaces of the coal.

Galena is the only lead-bearing mineral in the sandstone and one of the major metallic minerals. The bulk of the galena is rather uniformly disseminated throughout the sandstone as irregular grains approximately 0.1 to 0.5 mm in size (Figure 1). The galena often fills spaces between euhedral grains of quartz (Figure 2). A minor proportion of the galena is associated with coal.

Pyrite is the other major metallic mineral. It is concentrated in and around the coarser lenses and nodules of coal and only a small proportion is disseminated as fine, irregular grains in the sandstone. A minor amount of marcasite is associated with the pyrite.

Sphalerite is intergrown mainly with the pyrite and galena which occur with coal. A few grains of chalcopyrite are scattered through the sandstone. Fine grained rutile occurs as irregular disseminated grains in most of the specimens studied.

The sulphide minerals are concentrated in zones around the coal (Figure 3), replace part or all of the coal (Figure 4), and commonly fill the cellular spaces where the original plant texture remains (Figures 4 to 8). Pyrite is the most abundant of these sulphide minerals. Sphalerite and galena are much less common. Some sphalerite occurs in rhythmic zones in the pyrite (Figure 6). Calcite occurs in much of the coal in addition to the sulphide minerals (Figure 7).

Photomicrographs

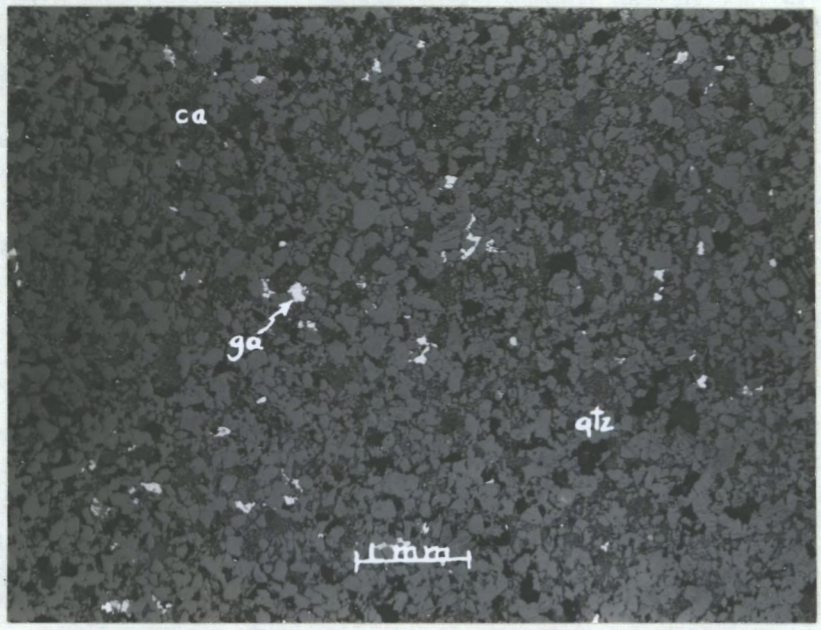

Figure 1. Disseminated galena (ga) in quartz (qtz) and calcite (ca). X15.

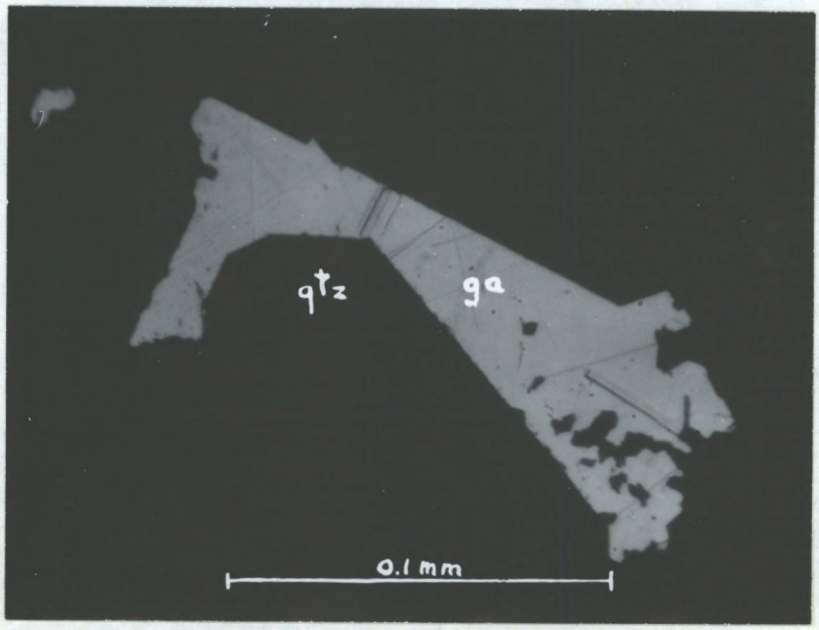

Figure 2. Galena (ga) outlining crystals of quartz (qtz). X500.

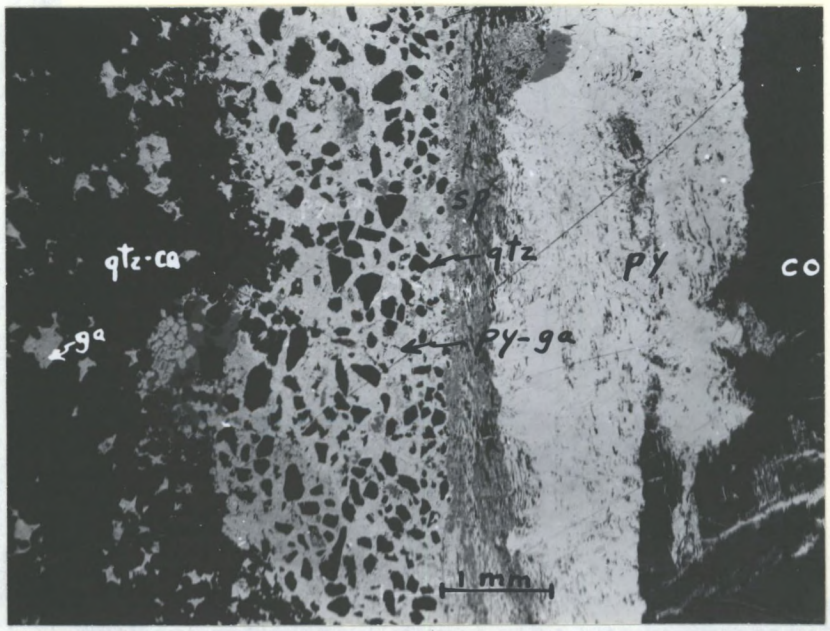

Figure 3. Zoned sulphides adjacent to coal (co) are pyrite (py), sphalerite (sp), and galena (ga). Disseminated galena also occurs in quartz and calcite (qtz-ca). X15.

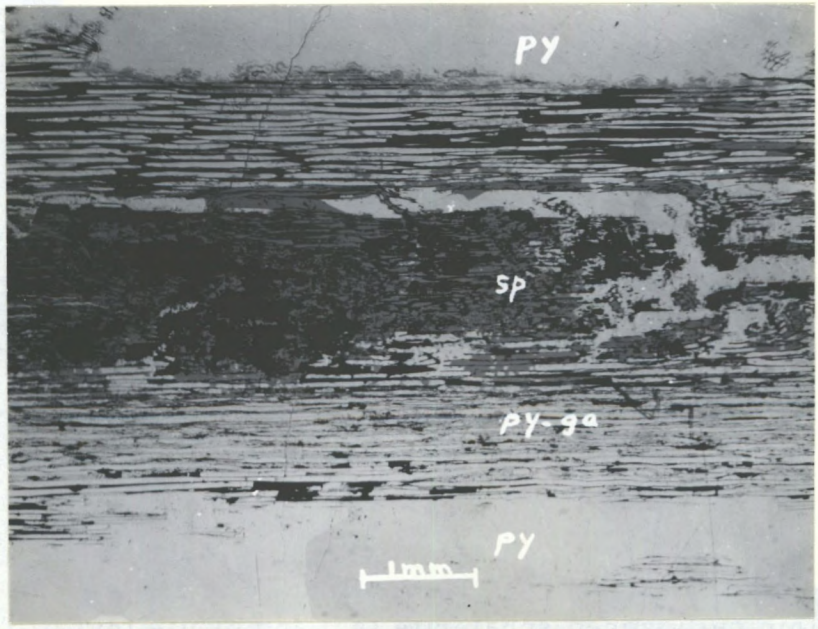

Figure 4. Pyrite (py), galena (ga), and sphalerite (sp) replacing and filling cells of original plant material. X15.

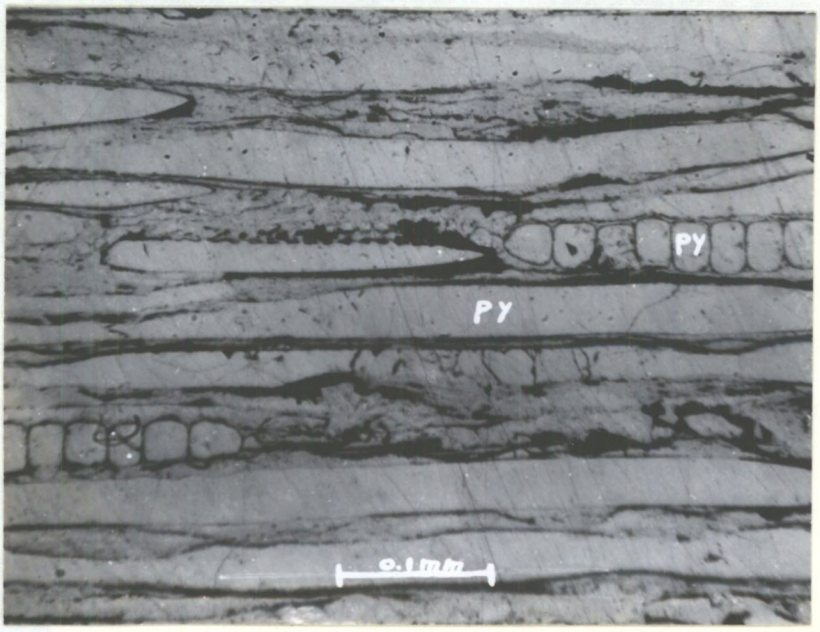

Figure 5. Enlarged view of pyrite (py) filling cells of original plant material. X200.

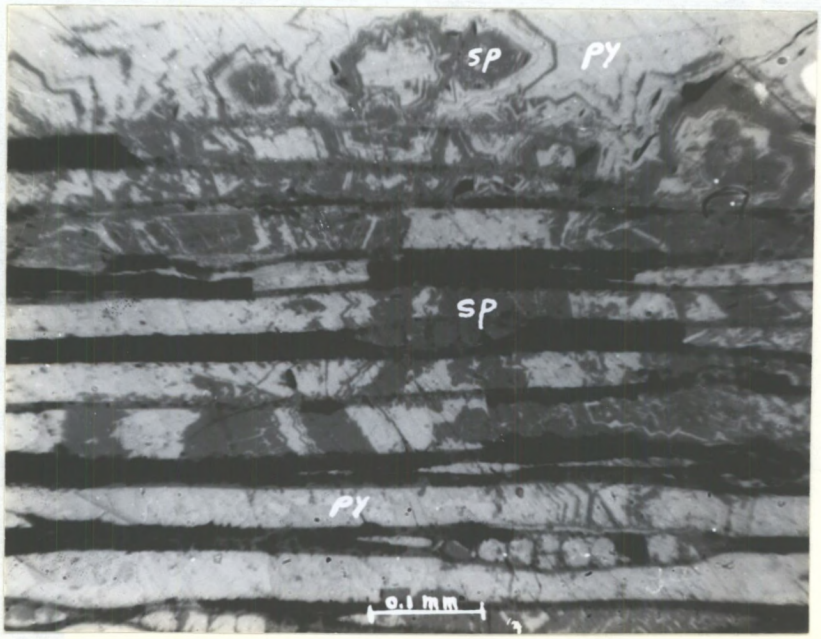

Figure 6. Rhythmically zoned sphalerite (sp) and pyrite (py) filling cells of original plant material. X150.

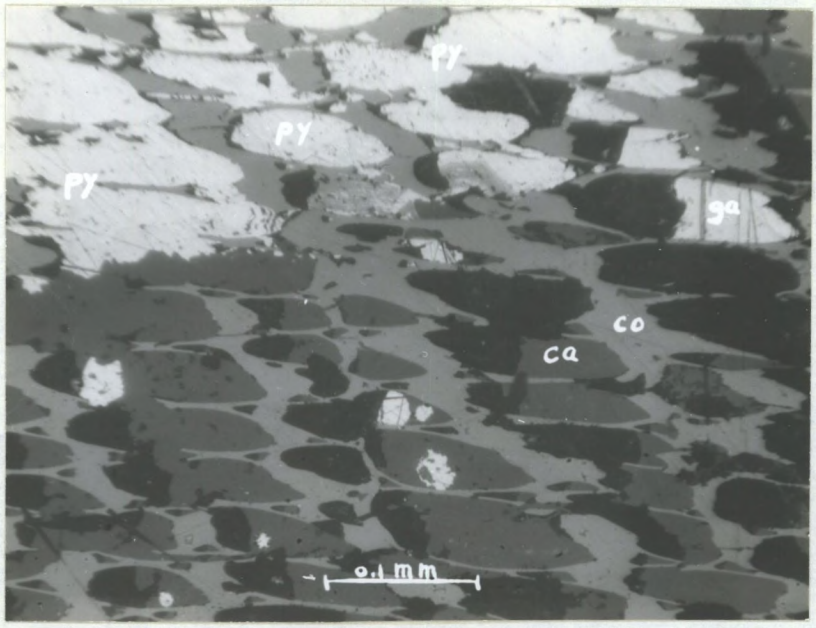

Figure 7. Pyrite (py), galena (ga), and calcite (ca) filling cells of original plant material in a nodule of brown coal (co). X150.

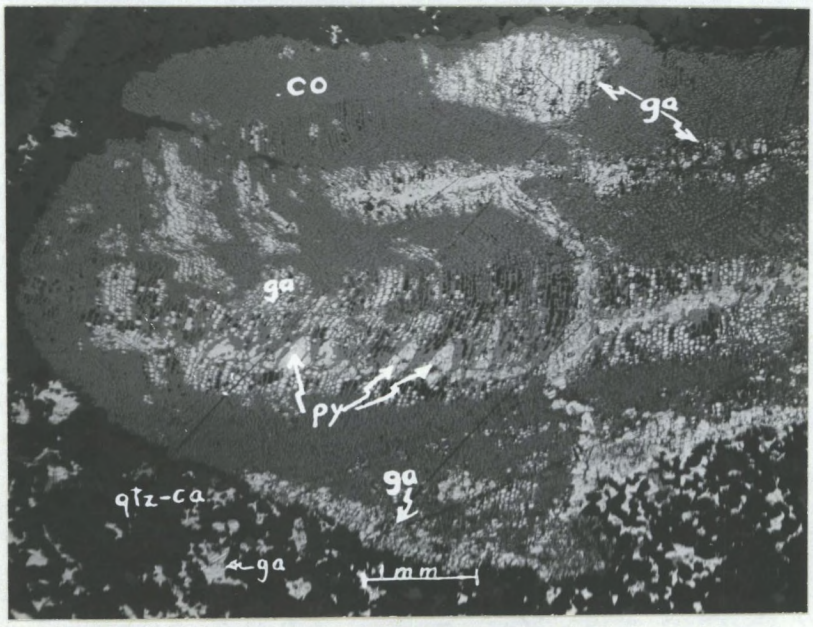

Figure 8. Incipient filling of cellular plant material in a nodule of brown coal (co) by pyrite (py) and galena (ga). Galena is also disseminated in the surrounding quartz and calcite (qtz-ca). X15.

DISCUSSION AND CONCLUSIONS

A sample of drill core from Phelps Dodge Corporation of Canada Ltd. is comprised of a light grey, fine grained soft and friable calcareous sandstone. Galena, the only lead-bearing mineral observed, is rather uniformly disseminated throughout the rock. The major proportion of this disseminated galena is not intergrown with other sulphide minerals. Pyrite and minor amounts of sphalerite and galena are concentrated in and around small lenses and nodules of coal present in the sandstone.

With respect to barite the results of the mineralogical investigation and of the chemical and semi-quantitative spectrographic analyses indicate that although it is a minor constituent it nonetheless is present to the extent of 1/10 of the amount of galena present in the ore.

MRH:SK/im