CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 58-207

A MINERALOGICAL REPORT ON A URANIFEROUS CONGLOMERATE FROM KLERKSDORP CONSOLIDATED GOLDFIELDS LIMITED, JOHANNESBURG, SOUTH AFRICA

by

M. R. HUGHSON

RADIOACTIVITY DIVISION

NOTE: THIS REPORT APPLIES ESSENTIALLY TO THE SAMPLES INVESTIGATED. THE REPORT ITSELF AND RELATED CORRESPONDENCE MAY NOT BE USED AT ANY TIME, IN WHOLE OR IN PART, FOR PUBLICITY OR ADVERTISING PURPOSES.

20

NOVEMBER 27, 1958

Investigation Report No. IR 58-207

A MINERALOGICAL REPORT ON A URANIFEROUS CONGLOMERATE FROM KLERKSDORP CONSOLIDATED GOLDFIELDS LIMITED, JOHANNESBURG, SOUTH AFRICA. REFERENCE NO. 5/58-9

by

M.R. Hughson*

ABSTRACT

The radioactivity in a weathered quartz pebble conglomerate is concentrated in thin seams of a very fine-grained, earthy, friable mixture of quartz, chlorite, and sericite paralleling the bedding. The chief source of uranium appears to be an unidentified, diffusely disseminated mineral. Small amounts of uranium are present in fine-grained monazite and cyrtolite. Both monazite and cyrtolite are sparsely disseminated in the matrix and in the earthy seams. Fine-grained betafite and hydrothorite are rare.

* Scientific Officer, Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

(6 pages)

INTRODUCTION

In a letter dated January 2, 1958 from Mr. H.M. Wright of Wright Engineers Limited, 802 Credit Foncier Bldg., 850 West Hastings St., Vancouver, B.C. it was stated that a sample of ore from Klerksdorp Consolidated Goldfields Limited, Johannesburg, South Africa, was being forwarded to the Mines Branch for test work. The sample of ore, weighing approximately five tons, was received on May 12, 1958.

This report is based on a mineralogical investigation of representative lump specimens of the ore. The ore treatment investigations are covered in the Mines Branch Investigation Reports IR 58-205 and IR 58-218. (1) (2)

The results of the analyses of the head sample are shown in Table 1.

TABLE 1

Analyses of Head Sample

Chemical Analyses	%
U_3O_8	0.27
ThO_2	0.12
Fe	7.47
Ti	0.62
Mo	0.021
Mn	0.25
Ni	0.052
As	0.05
CO_2(evolution)	0.27
CO_2(combustion)	1.20
U_3O_8 (secondary)*	0.067
S (combined)	1.77
P_2O_5	0.42
V_2O_5	0.022
Fire Assays	**oz/ton**
Au	0.035
Ag	0.095

* A sample is leached for 30 minutes in a hot, 10% Na_2CO_3 solution. The uranium dissolved is taken as an indication of the secondary uranium present.

========

ROCK COMPOSITION

The sample consists of a weathered quartz pebble conglomerate containing several uranium and thorium minerals. The specific gravity of a minus 10 mesh head sample is 2.81.

The pebbles are usually around 15 mm in diameter although they range in size from 2 to 30 mm. They are smoky-grey in colour or reddish-brown where fractures in the pebbles contain iron oxides.

The matrix between the pebbles is dark greenish-yellow in colour, and is earthy, and friable. It is essentially an intimate mixture of very fine-grained quartz, chlorite and sericite.

Pyrite is the most abundant of the sulphides which are fairly common in the matrix. It occurs as fine,irregular or subhedral cubic grains or occasionally as fine seams in fractures in quartz pebbles. Marcasite, chalcopyrite, arsenopyrite, and covellite are present in smaller amounts.

Fine-to medium-grained, translucent crystals of a pink garnet, almandite, are thinly scattered through the matrix. They often appear to be partly altered to a soft, opaque, creamy-white material. Fine, irregular grains of rutile, often intergrown with gangue and partly altered to anatase, occur throughout most of the matrix.

Also present are smaller amounts of monazite, magnetite, hematite, goethite, and columbite. There are traces of xenotime, hydrothorite, and betafite.

In some of the specimens the conglomerate grades into a fine- to medium- grained sandstone. The contact is usually sharp and roughly straight. It gives the rock a bedded appearance. Sulphides and other metallic minerals, and radioactive minerals, are usually not abundant in the sandstone.

Earthy, friable, greenish-yellow seams of very fine-grained quartz, chlorite, and sericite similar to the matrix follow the bedding of the rock in many of the specimens. The seams are usually several millimetres thick and rich in both metallic and radioactive minerals.

URANIUM MINERALOGY

The radioactive mineralization in this conglomerate is concentrated in the earthy, friable seams. To a lesser extent radioactive minerals also occur in the matrix between the conglomerate pebbles. Figures 1 and 2 show the distribution of the radioactivity. These autoradiographs show that much of the radioactive mineralization must be very fine-grained, although coarser grains around 1/5 mm in diameter are commonly present. Of the coarser, radioactive grains that have been identified, translucent, pale green monazite is most common. Spectrographic analysis of a pure sample showed <1 % uranium. A few soft, yellow to greenish-black grains turned out to be betafite. Hydrothorite was identified in one instance. Cyrtolite, a uraniferous variety of zircon occurring in the matrix, contains approximately 1% uranium.

The very fine-grained radioactive mineralization occurs when the matrix grades from the usual light greyish or yellowish-green to a pale yellow or yellowish-brown. The latter material when examined by x-ray diffraction methods gives a monazite pattern with a few unknown lines. However, semi-quantitative spectrographic analyses of pure grains of monazite and the pale yellow material indicate that the monazite does not account for all the uranium. It is believed that there must be another uranium-bearing mineral present although repeated x-ray diffraction patterns have not identified it.

Figure 1 - An autoradiograph showing the distribution of radioactivity in one of the earthy, friable seams along the upper edge of the specimen. X 1.

Figure 2 - An autoradiograph showing the distribution of radioactivity in the matrix between the quartz pebbles. X1.

CONCLUSIONS

Four radioactive minerals, monazite, cyrtolite, betafite, and hydrothorite, were identified in the matrix of a quartz pebble conglomerate. They are most abundant in seams of matrix material following the conglomerate bedding. It is believed that there is also an unidentified uranium-bearing mineral which accounts for a large part of the uranium present in the conglomerate. This mineral is very fine-grained which probably accounts for the difficulty in identifying it.

It is expected that the uranium occuring in the monazite and cyrtolite will not be easily extracted since these minerals are dissolved in acids only with difficulty. However, this would only be a small proportion of the uranium present in the conglomerate.

REFERENCES

1. V.F. Harrison, H.H. McCreedy, W.R. Honeywell, W.A. Gow, "Ore Treatment Investigations of Uranium-bearing Ore from Klerksdorp Consolidated Goldfields Ltd, South Africa." Mines Branch Investigation Report IR 58-205, Department of Mines and Technical Surveys, Ottawa, Canada, November 26, 1958.

2. V.M. McNamara, W.A. Gow, "Solvent Extraction Treatment of Solution Produced by Air Oxidation Pressure Leaching of Uranium-bearing Ore from Klerksdorp Consolidated Goldfields Ltd, South Africa." Mines Branch Investigation Report IR 58-218, Department of Mines and Technical Surveys, Ottawa, Canada, December 15, 1958.

MRH/dm