K. Dawson

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K.M. Dawson,
Research Geologist,
Canex Aerial Exploration Ltd.

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MINERALOGICAL STUDY OF EAST DODGER SCHEELITE CONCENTRATE

SUMMARY

1. Binocular microscope study of table concentrate confirms previous mineralogical studies. In addition, scheelite was seen to contain very small flakes of molybdenite and inclusions of powellite.

2. Electron microprobe analysis of homogeneous scheelite grains shows a MoO_3 content of 0.34%, as a solid-solution within the scheelite lattice.

3. Under the reflecting microscope and ultraviolet lamp, powellite is seen to occur as small (.01-.1 mm) inclusions in scheelite and as discreet grains, comprising about 1% of the specimen.

4. Placer lab and microprobe analyses of Mo content of concentrate are summarized:-

			New figures
MoS_2	molybdenite:	0.018%	.047 %
MoO_3	solid solution:	0.34	.34
MoO_3	powellite $CaMoO_4$:	0.648	.623
	Total Mo	1.006%	1.01

5. Low abundance and fine grain size of molybdenite in this specimen indicate it is not economically recoverable. Separation of the chemically similar phases powellite and scheelite poses a difficult metallurgical problem. Solid-solution MoO_3 in scheelite is not recoverable in milling.

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INTRODUCTION

A mineralogical study of East Dodger table concentrates was undertaken primarily to ascertain the nature and abundance of molybdenum minerals in the scheelite concentrate.

This study, in emphasizing Mo content, and in using research equipment at the University of British Columbia, will augment the detailed microscopic studies of C.W. Ball (1970a, 1970b).

MATERIAL STUDIED AND METHODS USED

A 6-16 specimen of table concentrate from the East Dodger orebody of Canadian Explorations Ltd. was used. The specimen was ground to about 200 mesh.

The specimen was split twice at the Placer Lab, with one-quarter for assay, one-quarter for mineralogical study, and one-half for storage.

In the mineralogical study, about 20 grams of concentrate were treated as follows:-

1. The specimen was separated magnetically on the Franz Isodynamic separator into three fractions: 0.4 amps magnetic; 1.0 amps magnetic; and 1.0 amps non-magnetic; the latter containing relatively pure scheelite.

2. Fractions were studied under the binocular microscope, minerals were identified, and a relatively pure scheelite specimen from the 1.0 amp non-magnetic fraction was mounted in bakelite for electron microprobe analyses.

3. The grain mount was analyzed for Mo content on the microprobe.

4. The same mount was examined under the reflecting microscope.

5. A split from the material mounted for microprobe analysis was analyzed on the X-Ray Diffractometer for identification of minerals present.

6. The three magnetically-separated fractions plus a sample of unseparated concentrate were examined under the ultraviolet lamp.

RESULTS

1. Microscopic Mineral Identification

Binocular microscope study of the concentrate confirms previous studies by C.W. Ball. In addition to minerals identified previously, powellite-scheelite intergrowths were seen, very fine-grained molybdenite was observed within scheelite grains, and trace amounts of a green octahedral mineral, tentatively identified as gahnite (Zn spinel) were detected. Mineralogical composition of the concentrate is given in Table 1.

Table 1
Mineralogy of East Dodger Table Concentrate

Mineral	Description	Estimated %
Scheelite	White, subhedral	94
Garnet	Orange to pink, grossularite (?)	3
Powellite	Greyish white, anhedral, in scheelite	1
Diopside	Pale green, subhedral prisms	1
Biotite	Fresh black plates	0.5
Tourmaline	Black needles in scheelite	< 0.5
Pyrrhotite	Anhedral cubes	< 0.5
Pyrite	Euhedral cubes	< 0.5
Magnetite	Octahedral to anhedral	tr.
Molybdenite	Small flakes in scheelite	tr.
Gahnite	Emerald green octahedra, rare	tr.

Molybdenite occurs as very small flakes, about 800 mesh size, enclosed within scheelite grains, and lesser amounts of discreet grains up

to 0.1 mm diameter.

Reflecting microscope examination of the scheelite specimen mounted for microprobe analysis revealed the two mineral phases illustrated in Figure 1.

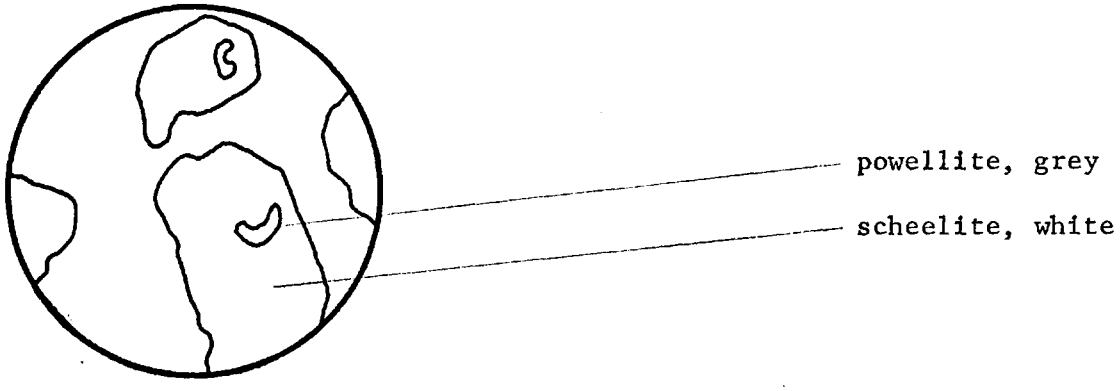

Figure 1

Sketch of Microprobe Mount
Magnification 360X.

Subhedral scheelite grains are white to translucent with relatively high reflectivity and weak to moderate birefringence. Powellite grains contained within scheelite are rounded and embayed, light grey with lower reflectivity than scheelite, and weakly birefringent. Form of powellite grains indicates either simultaneous eutectic crystallization or exsolution origin. About one half of the scheelite grains contain powellite.

2. Electron Microprobe Analysis

Microprobe analysis involves bombardment of specimen with a finely-focussed beam of electrons, and recording both the wavelength of emitted radiation with a spectrometer, and the amount of radiation with an electronic counter and digital recorder. Radiation from the specimen is compared with that from a pure Mo standard, and background

readings are obtained from the specimen and the standard. Mo content is calculated by subtracting background readings from standard and specimen readings, and taking a ratio.

Scheelite grain mount	
Average Mo counts from 19 grains tested:	27.05
Average Mo background counts:	21.10
Corrected Mo counts:	5.95

Mo Standard (100% Mo)	
Average of 20 readings:	1,805.7
Average Mo background counts:	23.5
Corrected Mo counts:	1,782.2

Average Mo content of homogeneous scheelite: $\frac{6}{1,782}$ = 0.34%.

The microprobe analysis represents a minimum figure for Mo content of homogeneous scheelite, since it pertains only to Mo accommodated within the scheelite lattice structure, not to Mo occurring as a separate powellite phase. The Mo content of the powellite inclusions was not determined on the probe.

3. Fluorescence Analysis

Specimens of unseparated concentrate plus magnetically separated fractions were examined under the ultraviolet lamp. The relatively pure scheelite fraction was found to contain almost all the powellite present, about half of which occurs as discreet yellow-fluorescing grains. Comparison of the over-all pale yellow fluorescent colour to a U.S.G.S. fluorescence colour chart indicates a MoO_3 content of about 0.72%.

4. X-Ray Diffractometer Analysis

A small fraction of the relatively pure scheelite sample used in microprobe analysis was mounted for x-ray identification of minerals. Unfortunately, scheelite and powellite are isostructural and yield almost identical diffraction patterns. The small amount of powellite present, about 1 percent, also contributed to the difficulties in x-ray identification. No attempt was made to separate powellite and x-ray it.

5. Assay Results

A split from the original concentrate sample was assayed at Placer's Vancouver lab, with the following results:-

		New fig's
Total Mo(acid soluble + MoO_3 in free and solid solution powellite):	1.006%	1.01
Acid soluble Mo (MoS_2 + any secondary MoO_3):	0.018	.047
. . . . .		
Solid solution MoO_3 in scheelite, from microprobe:	0.34	.34
MoO_3 as free powellite: (1.006-.358):	0.648	.623

CONCLUSIONS

East Dodger concentrate contains molybdenum in three distinct mineralogical phases:

Mo Phase	Description	Percent	
MoS_2 (molybdenite)	Very small flakes in scheelite	0.018	.047
MoO_3 (solid solution)	Replaces W in scheelite lattice.	0.34	.34
Ca (Mo,W) O_4 (powellite)	Inclusions in scheelite.	0.648 (MoO_3)	.623
	Total Mo	1.006%	1.01

In the sample studied, relatively minor amounts of Mo occur as potentially recoverable molybdenite. The fine grain size of molybdenite would necessitate grinding to about 800 mesh, resulting in considerable scheelite loss in slimes. Since the sample may not be representative of average size and abundance of contained molybdenite, additional studies of MoS_2 content of concentrates should be made.

Powellite occurs as small inclusions within scheelite and as discreet grains, ranging in size from .01-.1 mm. Examination of concentrate under ultraviolet light shows that about one-half the powellite content (i.e.0.5% of sample) occurs as individual grains that are potentially recoverable. However, separation of the chemically similar phases powellite and scheelite poses a difficult metallurgical problem.

Solid solution MoO_3 in scheelite is not recoverable in milling.

Respectfully submitted,

KMD/mm

Kenneth M. Dawson,
Research Geologist.

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REFERENCES

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