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**MICROFILMED**

SUMMARY REPORT

EL.21/74 - KING ISLAND

BY

L. G. SZABO

MELBOURNE, 1975

(Aug-Sept.)

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I. GEOLOGY

1. Regional Setting

King Island can be divided into two northerly striking units separated by a major unconformity:

(i) Pre-Cambrian basement complex consisting of strongly metamorphosed sediments and deformed granites.

The sedimentary rocks are dominantly quartzite, and muscovite schists.

The granitic rocks are generally fine grained and foliated though some varieties of coarse porphyritic granite, pegmatites and aplites also occur. Absolute age determination dates these rocks at 715 million years old.

The pleochroic haloes about the metamict zircons in the biotite of this granite range from 0.04 to 0.10 mm and average 0.067 mm.

(ii) Cambrian Sedimentary Sequence intruded by lower Carboniferous granite rocks.

The Cambrian rocks can be further broken down into three broad units:

- a. The older unit consisting of fine grained sandstone, siltstone and shale.
- b. Transitional zone of bedded shale and impure limestone. This unit is also known as "bedded foot-wall formation" of the Mine Series.
- c. The Mine Series is a sequence of pelitic and calcareous shales, impure and pure carbonate rocks and fragmental (tilloid) formation. The sedimentary sequence is intruded and overlain by dolerite and basalt.

This unit accommodates three scheelite and one molybdenum orebodies and two scheelite deposits in the south-east of the Island.

(iii) The Cambrian sequence has been intruded by lower Carboniferous granitic rocks which are relatively fresh, underformed and are known as tungsten and bolybdenum mineralisers at King Island.

The pleochroic haloes about the matamict zircons range from 0.01 to 0.05 mm and average at 0.027 mm, distinctly smaller than that of the pre-Cambrian granites, indicating that the latter is considerably older.

Three granitic stocks of lower Carboniferous age are known to occur at King Island:

- a) Grassy granodiorite being the source of the Open Cut, and Dolphin ore bodies, Western and Miller's Block scheelite deposits.
- b) Bold Head adamellite which has been responsible for the Bold Head scheelite orebody and molybdenite deposit.
- c) Mt. Counsel adamellite the contact aureole of which is the subject of the present investigation

The trace element concentration of the three granitic stocks have been investigated and compared with Russian analogues. The results are tabulated below:

Trace element concentration of granitic rocks

TABLE 1

Description	Sample	Mo	W	Sn
		Parts per million		
Grassy granodiorite	Mb-7	2	2	15
Bold Head adamellite	CZ-15	2	2	10
" " "	51	1	3	30
Mt. Counsel adamellite	C2-8	2	2	10
" " "	A - 1	2	2	12
" " "	C2-13	2	2	8
" " "	50	2	2	15
Barren granites	PZ-6 *	1.5	1.5	2.4
" " "	Shkh-95 *	0.8	1.5	2.3
" " "	Ts-23 *	0.8	1.2	3.4
" " Ukraine	11 samples**		3.0	
" " Caucasus	15 "		1.8	
" " Central				
" " Kalba	32 "	**	1.5	
" " Zabaikale	8 "	**	3.0	

(Contd.)

\* Published by Ivanova, G.F. and Butuzova, Y.G., Distribution of Tungsten, Tin and Molybdenum in the Granites of Eastern Transbaykaliya, 1968, Moscow.

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Description	Sample No.		Mo	W	Sn
			Parts per million		
Mineralising granites	KL-44	*	1.1	1.3	6.1
" "	KL-3	*	0.8	1.2	15.0
" "					
" Leucogranite granites	11 samples**			3.3	
" Two-mica granite	30 "	**		7.8	
" Granite with greisen	32 "	**		23.0	

\*\* Published by Kreiter, V.M., Teoreticheskie osnovy poiscov i razvedki tverdykh polezhykh iscopaemykh, Poiski, Nedra, Moscow.

The concentration of tungsten and molybdenum of granites are moderately affected by associated areas of mineralization. Tin, however, is enriched by a factor of at least five in the granitic rocks of mineralised areas.

The Mt. Counsel adamellite is similar in all aspects to the Bold Head and Grassy stocks. It is reasonable, therefore to conclude that tungsten/molybdenum mineralization occurs in its contact aureole.

## 2. Mineralisation Control - Exploration Targets

The known scheelite deposits of south-east King Island are hosted by andradite skarn, garnet diopside skarn and hornfels which developed along and adjacent to major fractures in the contact aureole of lower Carboniferous granitic intrusives.

The bulk of tungsten was introduced into the skarn through major fractures resulting in large low grade disseminated scheelite deposits in the skarn while high grade scheelite and molybdenite deposits emplaced into the channelways.

The targets of exploration for this type of deposits are

- (i) Mineralising granitic intrusives
- (ii) Meaningful tungsten and molybdenum geochemical anomalies in the contact aureole
- (iii) Carbonate rocks in the proximity of granitic intrusive.
- (iv) Major fracture zones filled with minerals of hypothermal origin.

3. Exploration Licence 21/74

The area under review is centrally situated in the eastern half of King Island.

Some outcrops and extensive auger drilling infer that the area covers the sedimentary sequence from pre-Cambrian schists to Mine Series rocks, inclusive.

In the west the area is comprised of regionally metamorphosed sedimentary rocks striking north-south, decreasing in metamorphic grade to the east and composed essentially of mica schists and sandstone to a lesser degree.

In the central zone the sandstone-siltstone unit of Cambrian age have been mapped.

Siltstone, shale and their contact altered varieties have been encountered in the eastern zone. DDH-R1 intersected a sequence of quartzite and pelitic hornfels with a band of garnet pyroxene hornfels. The sequence has been correlated with the lower part of bedded foot-wall formation of the Mine Series.

Rock cuttings, correlative with the Mine Series, have been recovered from four auger holes immediately east of DDH-R1.

A northerly elongated intrusive stock called Mt. Counsel Adamellite of lower Carboniferous age occupies the northern part of the Licence area. Several apophyses of the adamellite have been outlined by outcrop mapping and auger drilling.

It is probable that extensive fracture zones and faults developed during the emplacement of adamellite and its apophyses. The fractures could have served as channels for the mineralising fluids which carried, injected and deposited tungsten and/or molybdenum into the invaded rocks. Geochemical anomalies encountered in the contact aureole substantiate the relevance of this inference.

4. Conclusions

- (i) Mineralising granitic intrusives of lower Carboniferous age are present in the area (Mt. Counsel Adamellite).
- (ii) The rocks of bedded footwall formation of Mine Series are present in the area (DDH-R1).
- (iii) East of DDH-R1 auger cuttings indicate the presence of calcareous member of the Mine Series.

## II. GEOCHEMISTRY

178 Auger samples of residual soil, analysed for tungsten and molybdenum, have been included in the present evaluation.

### 1. Statistical Methods

Tungsten and molybdenum are lognormally distributed in the rocks. The natural logarithm of the assays were, therefore, used for the estimation of mean and standard deviation:

$$x = \frac{\sum_{i=1}^n \ln a_i}{n} \quad (1)$$

and

$$s = \sqrt{\frac{1}{n-1} \left( \sum_{i=1}^n \ln a_i^2 - \frac{\left( \sum_{i=1}^n \ln a_i \right)^2}{n} \right)} \quad (2)$$

where

- x = mean of  $\ln a$
- s = standard deviation
- a = assay
- n = number of assays

Mean tungsten and molybdenum values ( $\bar{x}$ ) were calculated by

$$\bar{x} = e^x, \text{ ppm} \quad (3)$$

and threshold values were computed by using the conventional formulae

$$t_r = e^{(x + s)}, \text{ ppm} \quad (4)$$

and

$$t_1 = e(2s + x), \text{ ppm} \quad (5)$$

where

$t_r$  = regional threshold

$t_1$  = local threshold

Contrast factors were calculated for the local threshold and for the anomalous assays:

$$C_t = \frac{t_1}{\bar{x}} \quad (6)$$

and

$$C_A = \frac{A}{t_1} \quad (7)$$

where

$C_t$  = contrast of local threshold

$C_A$  = contrast of anomalous assay

A = anomalous assay.

The basic data, mean and threshold values for each rock type involved are shown on Tables 2 to 5.

Mean and threshold values for granite and contact altered rocks are contoured on Fig. 1 and 2.

## 2. Tungsten

Over the granite, the source of tungsten mineralisation, the mean of tungsten is the second highest: 9.39 ppm.

The highest mean and lowest standard deviation were yielded by alluvium in the foreground of the granite stock where gravity-enrichment of tungsten took place during the transportation of granite detritus.

In the contact metasomatised aureola the mean and contrast of local threshold are much higher east of the granite where calcareous rocks were encountered, than in the West where silicicous detrital sediments occur exclusively.

Two significant anomaly have been recorded east of the granite.

Anomaly W-1 extends along the intrusive contact in the north and west and is open in the south.

The anomaly is represented by 14 assays above the mean. One of two anomalous assays is 2.27 times greater than the local threshold of 68 ppm.

Anomaly W-2 is indicated by two assays.

One of the assays is 3.6 times greater than the local threshold.

West of the granite meaningful anomalies were not found in association with the bedrock.

### 3. Molybdenum

The molybdenum shows a tendency to be concentrated in later magmatic differentiates, and its mobility is higher than that of tungsten.

The molybdenum displays little resistance to weathering. For these reasons the molybdenum is evenly dispersed around the source.

Higher concentrations of molybdenum were found in the residual soil over the contact altered rocks east of the granite. In the latter the contrast of local threshold is the highest : 5.7.

Two anomalies have been recorded:

Anomaly Mo-1 is represented by 10 assays above the mean, and four assays above the regional threshold. Two of the assays are 2.91 and 1.59 times greater than the local anomaly threshold.

Anomaly MO-2 is indicated by five assays above the mean and one assay being greater than the regional threshold.

Significant anomalies have not been found in the western part of the contact aureola within the licence area.

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4. Conclusions

- (i) Anomaly W-1 and Mo-1 overlap each other and are considered to be very significant.
- (ii) Anomaly W-2 seems to indicate the source of the secondary tungsten enrichment in the alluvium. The moderate anomaly Mo-2 in the proximity support this theory.

III. ADDENDUM

In August, 1975, five auger holes were drilled in Anomaly W-2 area. The position of the holes are shown in Fig. 1.

Three holes (Nos. 1 - 3) did not reach the bedrock at 20 m depth.

In hole No. 4 siliceous hornfels were encountered. The sample assayed

W            85 ppm

Mn           4 ppm

Hole No. 5 encountered heavily fractured rock at 20.5 m. Core drilling recovered pyroxene hornfels with disseminated scheelite assaying 0.27%  $WO_3$  between 20.5 and 23.0 m. The core recovery was poor, 8.4% (21 cm).

IV. DRILLING PROGRAMME

37 Auger holes were proposed to be drilled for 700 m of total drilling.

At least one diamond drill hole will also be put down in the area of Anomaly W-2.

The proposed drill sites are shown on Fig. 1.

1. Anomaly W-1 and Mu-1

18 Auger holes will be drilled on 100 m by 200 grid to the bedrock surface to further define the anomaly.

2. Anomaly W-2

11 Auger holes will be drilled to the bedrock surface and core will be taken from the bedrock in order to obtain structural data required for the positioning of the diamond drill hole(s).

At least one diamond drill hole will be sunk to a depth between 100 m and 200 m.

3. Regional Reconnaissance

8 Auger holes will be drilled further south, east of the granite, on the regional (200 m by 400 m) grid.

TABLE 2BASIC DATA FOR THE ESTIMATION OF MEAN AND ASSOCIATED GEOCHEMICAL PARAMETERSELEMENT: Tungsten

Rock Type	n	$\sum_{i=1}^n \ln a_i$	$\sum_{i=1}^n \ln a_i^2$	x	s	s + x	2s + x
Granite	86	129.69	520.40	2.24	1.02	3.26	4.28
Contact altered rocks east of the granite	36	63.43	164.63	1.76	1.23	2.99	4.22
Contact altered rocks west of the granite	33	35.59	45.99	1.08	0.49	1.57	2.06
Sandstone, siltstone shale	5	6.87	11.40	1.37	0.70	2.07	2.77
Bioclastics (Tertiary)	3	0.69	0.48	0.23	0.40	0.63	1.03
Alluvium	15	37.80	103.52	2.52	0.77	3.29	4.06

TABLE 3

MEAN AND ASSOCIATED GEOCHEMICAL PARAMETERSELEMENT: Tungsten

ROCK TYPE	MEAN	ANOMALY THRESHOLDS		SAMPLES ABOVE THRESHOLDS				CONTRAST OF LOCAL THRESHOLD
		REGIONAL	LOCAL	REGIONAL		LOCAL		
	PPM	PPM	PPM	No.	%	No.	%	
	$\bar{x}$	$\sigma(\bar{x})$	$\sigma(2\bar{x})$					
Granite	9.39	26.05	72.24	13	15.1	3	3.5	7.69
Contact altered rocks east of the granite	5.81	19.89	68.03	4	11.1	2	5.6	11.71
Contact altered rocks west of the granite	2.94	4.81	7.85	6	18.2	2	6.1	2.67
Sandstone, siltstone, shale	3.94	7.92	15.96	1	20.0	-	-	4.05
Bioclastics (Tertiary)	1.26	1.88	2.80	1	33.3	-	-	2.22
Alluvium	12.43	26.84	57.97	3	20.0	-	-	4.66

TABLE 4

BASIC DATA FOR THE ESTIMATION OF MEAN AND ASSOCIATED GEOCHEMICAL PARAMETERSELEMENT: Molybdenum

Rock Type	n	$\sum_{i=1}^n \ln a_i$	$\sum_{i=1}^n \ln a_i^2$	$\bar{x}$	s	s + $\bar{x}$	2s + $\bar{x}$
Granite	86	63.42	87.49	0.74	0.69	1.43	2.12
Contact altered rocks east of the granite	36	43.21	78.11	1.20	0.87	2.07	2.94
Contact altered rocks west of the granite	33	30.30	48.91	0.92	0.81	1.73	2.54
Sandstone, siltstone, shale	5	1.39	0.96	0.28	0.38	0.66	1.04
Alluvium	15	20.62	31.73	1.37	0.49	1.86	2.35
Bioclastics (Tertiary)	3	2.77	3.84	0.92	0.80	1.71	2.52

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TABLE 5

MEAN AND ASSOCIATED GEOCHEMICAL PARAMETERSELEMENT: Molybdenum

ROCK TYPE	MEAN PPM $e^x$	ANOMALY THRESHOLDS		SAMPLES ABOVE THRESHOLDS				CONTRAST OF LOCAL THRESHOLD
		REGIONAL PPM	LOCAL PPM	REGIONAL		LOCAL		
		$e^{(s+x)}$	$e^{(2s+x)}$	No.	%	No.	%	
Granite	2.09	4.18	8.33	14	16.3	1	1.2	3.99
Contact altered rocks east of the granite	3.32	7.92	18.92	5	13.9	2	5.6	5.70
Contact altered rocks west of the granite	2.51	5.64	12.68	5	15.2	1	3.0	5.05
Sandstone, siltstone, shale	1.32	1.93	2.83	2	40.0	-	-	2.14
Bioclastics (Tertiary)	2.52	5.58	12.43	-	-	-	-	4.93
Alluvium	3.95	6.42	10.49	2	13.3	-	-	2.66

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PROGRESS REPORT

E.L. 21/74 - KING ISLAND

BY

L.G. SZABO

MELBOURNE, 1976.

(SEPT.?)

SUMMARY

Geochemical auger programme comprising 18 holes and totalling 406 m, have been completed.

Tungsten geochemistry has further defined Anomaly W - 1.

Diamond drilling programme has been developed to test Anomaly W - 1.

One auger hole has been developed to temporary water - well to supply water for diamond drilling.

DRILLING AND GEOCHEMICAL RESULTS

Hole No	Depth m	Tungsten ppm	Molybdenum ppm
34	24	8	2
35	27	6	2
36	23	2	2
37	25	8	2
38	<del>28</del>	16	2
39	25	2	2
40	25	80	2
41	26	110	8
42	27	42	4
43	27	16	2
44	26	8	2
45 <sup>18</sup>	18	8	2
46	19	30	4
47	20	18	6
48	17	15	2
49	17	120	2
50	18	20	2
51	14	8	2

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GEOCHEMISTRY

Geochemical auger programme has been completed on close grid in Anomaly W - 1 area.

The tungsten geochemistry superposed on the structure of the Cambrian sedimentary sequence indicate that the source of the anomaly has a shape of northerly elongated zones, probably strata with easterly dip. The zones are abruptly terminated in the north and south towards the granite and an inferred fault, respectively.

The molybdenum geochemistry remains inconclusive.

Anomaly W - 2 has not been investigated in the six months' period.

CONSTRUCTION OF TEMPORARY WATER WELL

Bore No 41 has been developed to temporary water well to supply water for diamond drilling.

Well log:	0 - 4 m	sand and clay
	4 - 9 m	fine sand
	9 - 24 m	medium to coarse sand interbedded with clay and peat
	24 - 26 m	clay and siltstone cuttings
Casing:	0 - 12 m	4" PVC pipe with approx. 1 mm slots from 8- 12 m.

DRILLING PROGRAMME

Three diamond drill holes have been planned to test Anomaly W - 1.

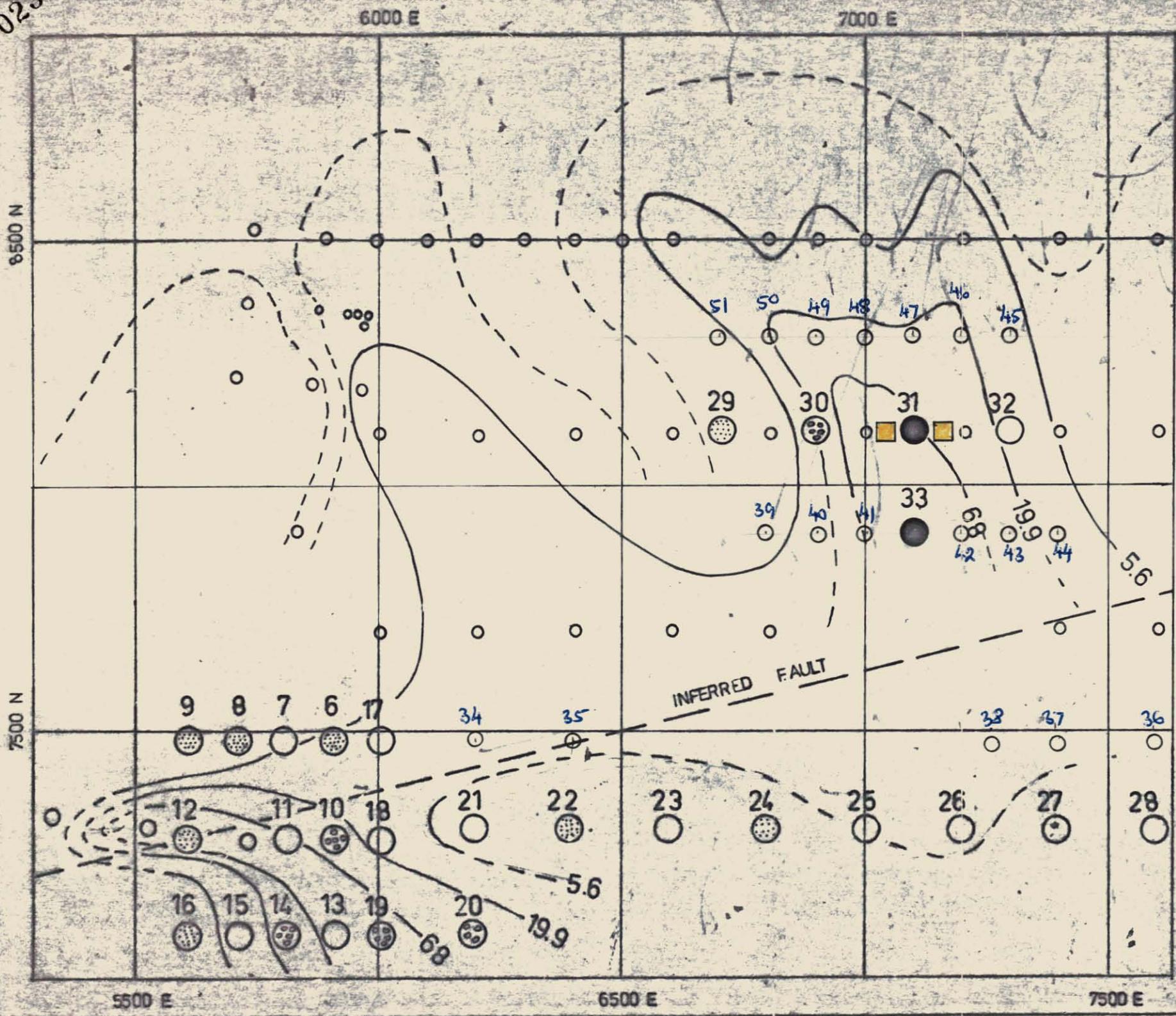
Details of two proposed holes are:

DDH - 1	Co-ordinates:	8100 N
		7050 E
	Inclination	60° W
	Depth	110 m
DDH - 2	Co-ordinates	8100 N
		7075 E
	Inclination	60° W
	Depth	160 m

Auger drilling will be continued along the inferred fault and south east of Anomaly W - 2 in order to outline further target areas.

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**TUNGSTEN GEOCHEMISTRY**  
**E.L. 21/74--KING ISLAND**  
**SCALE: 1:10 000**

- GRANITE
- SILICEOUS HORNFELS
- CALCAREOUS HORNFELS
- PEAT
- Proposed diamond drill hole

5 cm

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PROGRESS REPORT

E.L. 21/74 - KING ISLAND

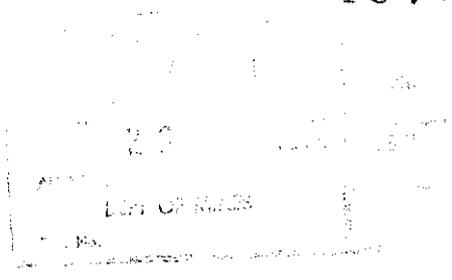
BY

L. G. SZABO

MELBOURNE, 1976

(AIRIL)





GEOCHEMISTRY

The drilling programmes have confirmed the presence of two significant tungsten anomalies designated W - 1 and W - 2.

The anomalies appear to have been displaced some 1000 m horizontal distance apart on a major fault.

The northern anomaly, W - 1, appears to have originated from a stratigraphically controlled source as its long axis is parallel to the strike of the Cambrian rocks of the region.

Anomaly W - 2 forms a distinct angle with the regional fault and the general strike of the rocks. The source of the anomaly can therefore be controlled by either fractures or stratigraphy or both.

Although higher tungsten values have been recorded in anomaly W - 2 area, anomaly W - 1 is a better exploration target owing to more obvious stratiform properties.

DRILLING AND GEOCHEMICAL RESULTS

Hole No.	Depth m	Core recovery m	Rock type	Tungsten ppm	Molybdenum ppm
6	21.3	.03	Si	8	2
7	21.3	-	-	4	4
8	23.1	.05	Si	2	6
9	27.0	.05	Si	2	2
10	24.3	.05	Ca	22	4
11	23.1	.-	-	70	4
12	27.0	-	-	220	2
13	24.9	-	-	80	4
14	28.2	.03	Ca	32	8
15	30.4	-	-	15	2
16	31.7	.03	Si	2	2
17	21.3	-	-	8	2
18	26.0	-	-	8	4
19	26.2	.02	Ca	80	6
20	30.5	.02	Ca	25	4
21	21.3	-	-	2	2
22	24.2	.05	Si	2	2
23	22.3	-	-	2	2
24	24.2	.05	Si	4	4
25	25.0	-	-	6	10
26	25.3	-	-	8	12
27	21.0	-	-	2	4
28	21.0	-	-	2	2
29	21.3	.10	Si	4	2
30	22.5	.05	Ca	8	5
31	21.3	*	Peat	-	-
32	26.0	-	-	16	6
33	22.7	*	Peat	-	-

Notes: Si Siliceous hornfels  
Ca Calcareous hornfels  
\* Peat on auger flites

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1975

DRILLING PROGRAMME

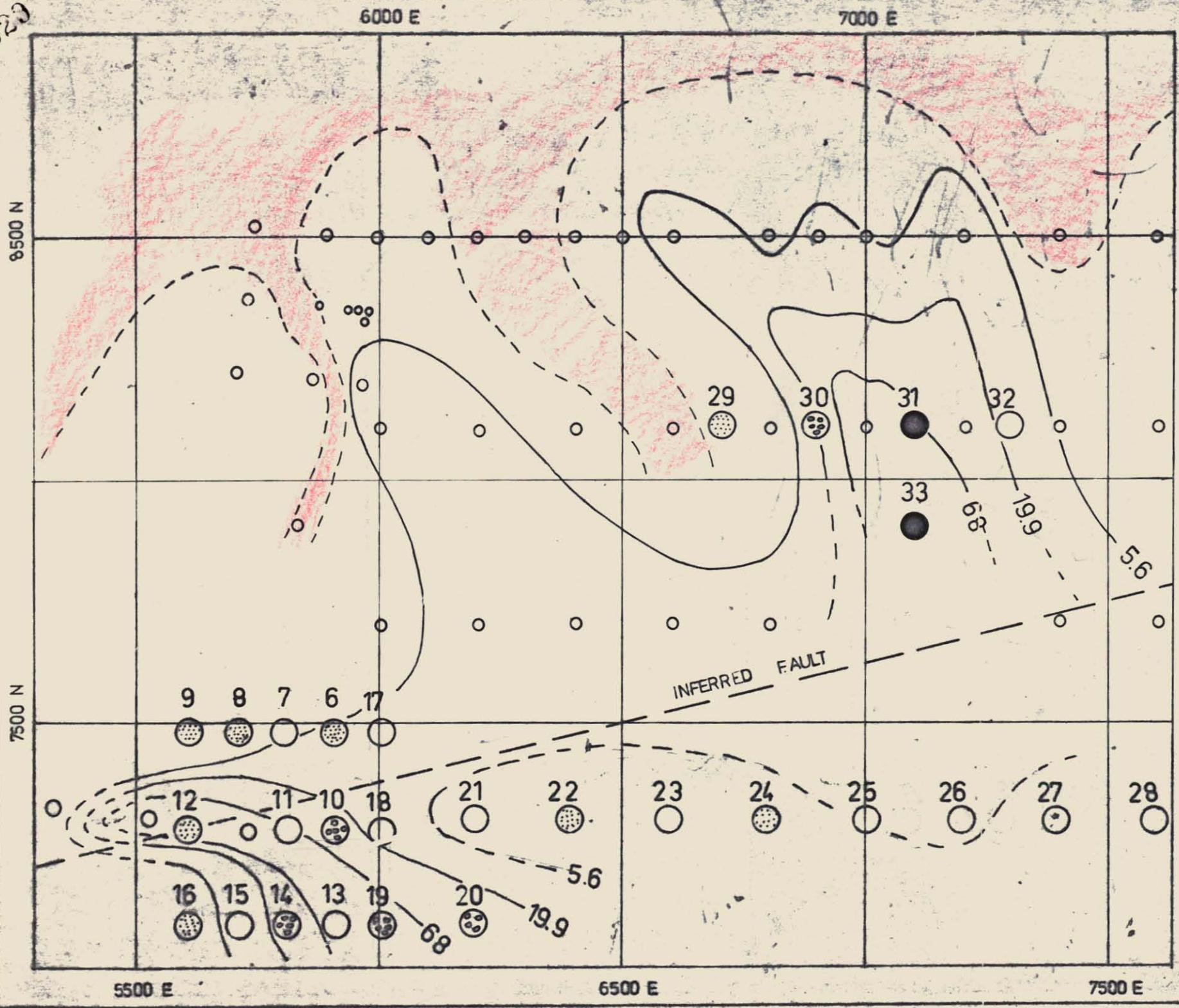
Auger drilling will be continued on close grid in Anomaly W - 1 area in order to define diamond drilling target(s).  
13 holes will be drilled for a total of 350 m.

9 auger holes totalling 250 m will be drilled 200 m apart on the regional line 6900 N, 400 m south of the existing regional survey line.

Should the weather conditions permit working in the swampy area during the wet season, one diamond drilling hole will be put down to a depth between 100 m and 200 m.

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### TUNGSTEN GEOCHEMISTRY

E.L. 21/74—KING ISLAND

SCALE: 1:10 000

- GRANITE
- SILICEOUS HORNFELS
- CALCAREOUS HORNFELS
- PEAT

5 cm

5500 E

6500 E

7500 E

8500 N

7500 N

8000 N

6000 E

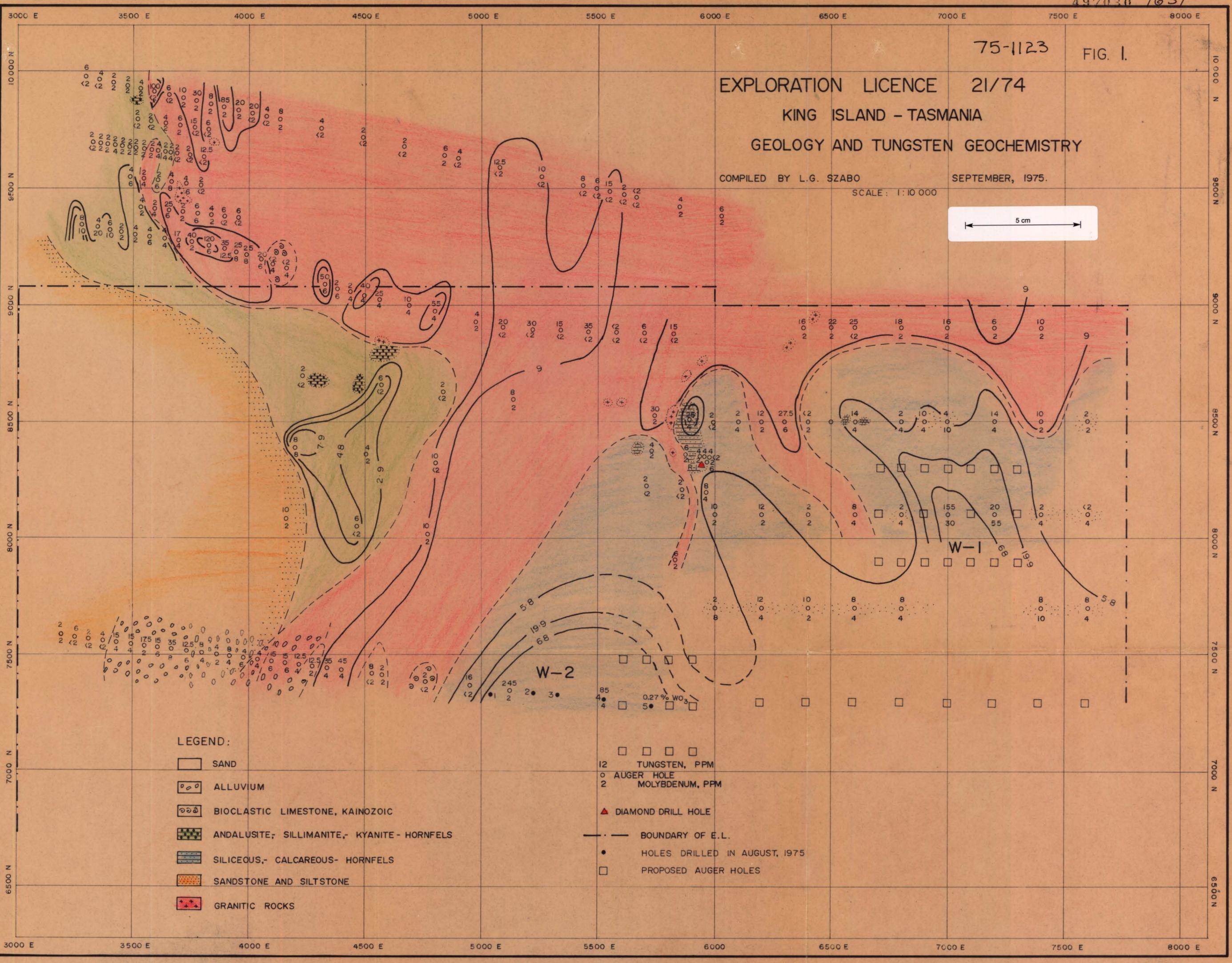
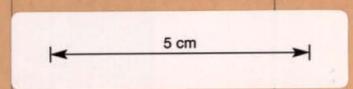
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# EXPLORATION LICENCE 21/74 KING ISLAND - TASMANIA GEOLOGY AND TUNGSTEN GEOCHEMISTRY

COMPILED BY L.G. SZABO

SEPTEMBER, 1975.

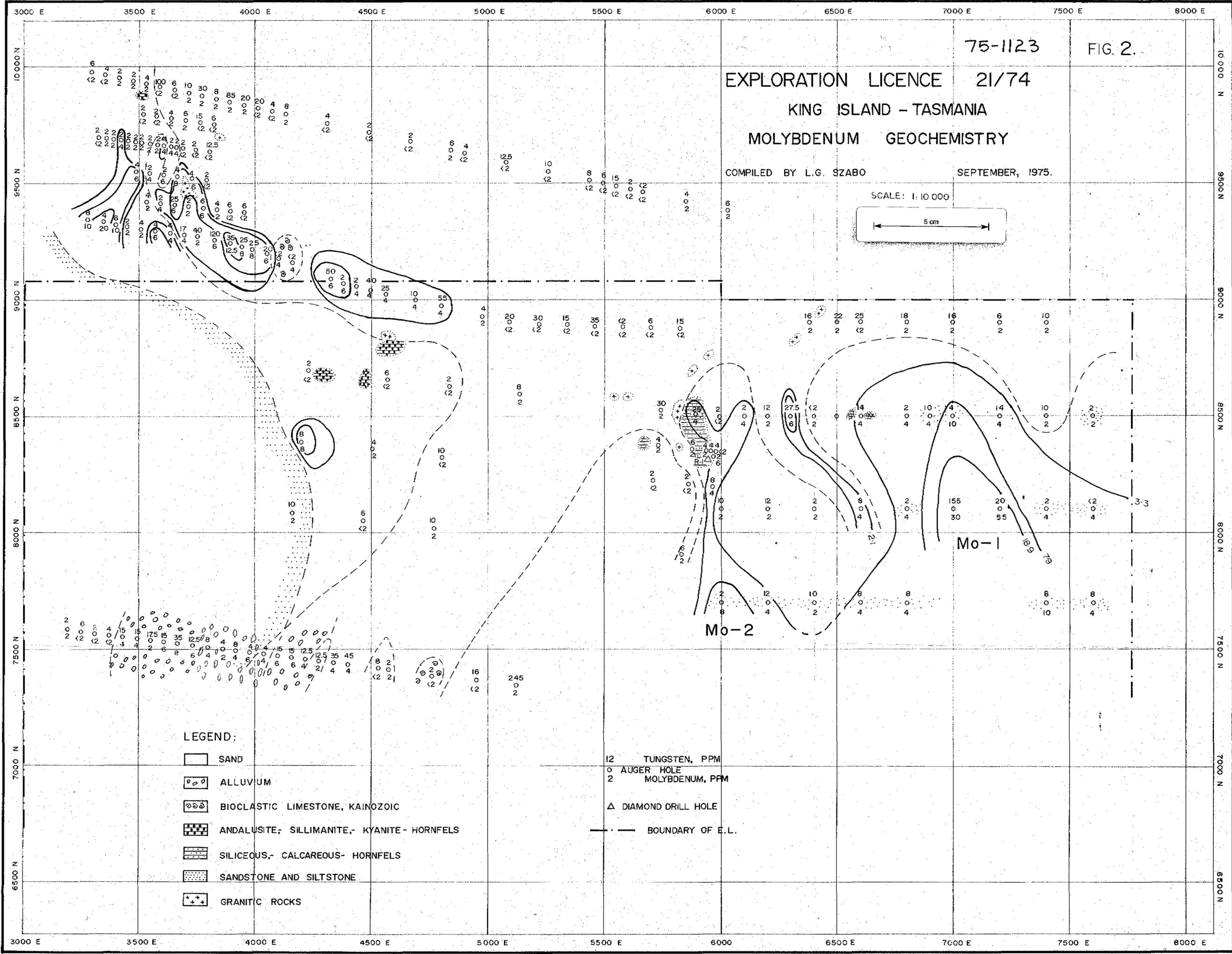
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### LEGEND:

- SAND
- ALLUVIUM
- BIOCLASTIC LIMESTONE, KAINOZOIC
- ANDALUSITE, SILLIMANITE, KYANITE - HORNFELS
- SILICEOUS, CALCAREOUS - HORNFELS
- SANDSTONE AND SILTSTONE
- GRANITIC ROCKS

- TUNGSTEN, PPM
- AUGER HOLE
- MOLYBDENUM, PPM
- DIAMOND DRILL HOLE
- BOUNDARY OF E.L.
- HOLES DRILLED IN AUGUST, 1975
- PROPOSED AUGER HOLES



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FIG. 2.

EXPLORATION LICENCE 21/74

KING ISLAND - TASMANIA

MOLYBDENUM GEOCHEMISTRY

COMPILED BY L.G. SZABO

SEPTEMBER, 1975.

SCALE: 1:10 000



LEGEND:

- SAND
- ALLUVIUM
- BIOCLASTIC LIMESTONE, KAINOZOIC
- ANDALUSITE, SILLIMANITE, KYANITE - HORNFELS
- SILICEOUS, CALCAREOUS - HORNFELS
- SANDSTONE AND SILTSTONE
- GRANITIC ROCKS

- 12 TUNGSTEN, PPM
- o AUGER HOLE
- 2 MOLYBDENUM, PPM
- Δ DIAMOND DRILL HOLE
- BOUNDARY OF E.L.