

1981/14. Exploratory diamond drilling at the All Nations mine, Moina.

P.L.F. Collins

*Abstract*

Quartz veins with wolframite trending 105°M and dipping 75°-80°S (the All Nations lode) have been dislocated by a low angle reverse fault which occurs as a fault zone 20 m thick and dipping 20°N. A two-hole exploratory diamond drilling programme has indicated a quartz vein (0.5 m and 0.3 m true width) with wolframite, molybdenite and bismuthinite occurring within Cambrian quartz and quartz-feldspar porphyry which underlies the Ordovician sediments hosting the All Nations lode. The vein system (strike 115°M and dip 80°-90°S) in the porphyry has been faulted into approximate juxtaposition with the All Nations lode above. The Cambrian porphyry also contains numerous narrow quartz and quartz-topaz veins bearing wolframite and molybdenite, and includes thin bands of magnetite and garnet-bearing skarn-type alteration.

#### INTRODUCTION

This report details the results of the first two holes of an exploratory diamond drilling programme at the All Nations mine in northern Tasmania. The drilling was undertaken by the Department of Mines under Aid to Mining assistance, at the request of the lessees of Mineral Lease 24M/60 (4.047 ha) and the surrounding Mineral Lease 66M/78 (32.00 ha).

#### LOCATION AND ACCESS

The All Nations mine [DQ243060] is situated at the head of Narrawa Creek, approximately 2 km east of Moina (fig. 1). The mine is readily accessible by a vehicle track which leaves the Cradle Mountain Road at a point 1.8 km south of the Cethana Road intersection.

#### HISTORY OF THE EXPLORATION PROGRAMME

In January 1978, a request was received from L.M. Graue, W.P. Kidd, and L.J.C. Singleton (lessees of Mineral Lease 24M/60) for advice and assistance to relocate the All Nations lode, which has been dislocated by a low angle reverse fault. Following an investigation of the mine a diamond drilling programme was recommended, to explore for either the All Nations lode or similar quartz-wolframite lodes beneath the reverse fault (Collins, 1978). In June 1978, Lease 24M/60 was transferred to Graue and Kidd, and Kibuka Mining Pty Ltd entered into a 12 months option agreement over the Lease. Also in June 1978, M.T. Ellis obtained forfeiture of Mineral Lease 7M/72 (32 ha) which surrounds 24M/60, and entered into partnership with Graue and Kidd. Mineral Lease 66M/78 was subsequently granted to Ellis.

Another request for advice and assistance was received from Graue, Kidd, and Ellis in April 1979, and exploratory drilling was again recommended. In September 1979, the lessees applied for assistance under the Aid to Mining Act for exploratory diamond drilling to be undertaken. The application was approved and drilling commenced in February 1980.

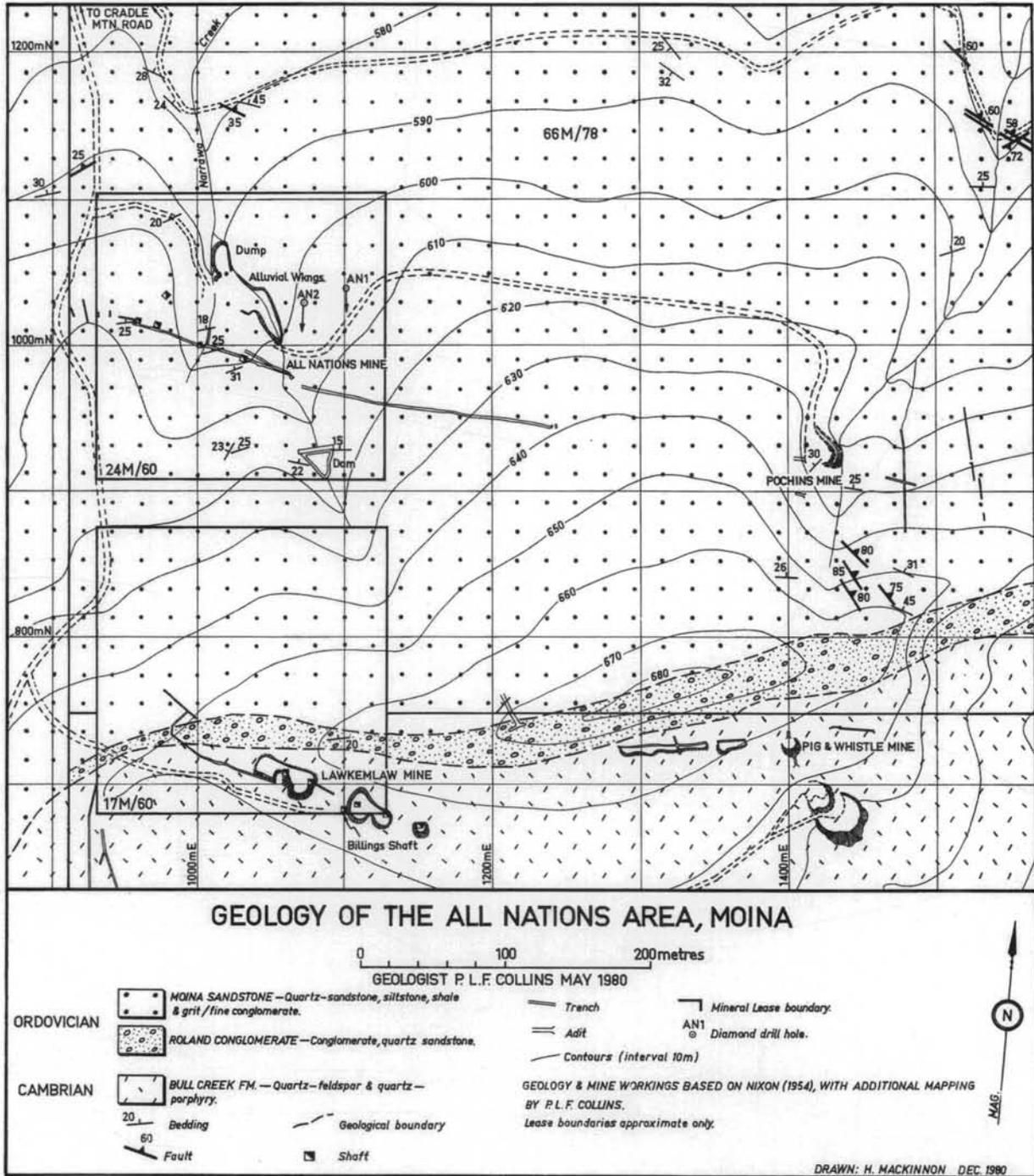
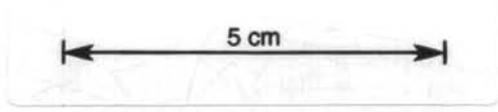


Figure 1.



GEOLOGICAL SETTING

The oldest rock in the area is the massive, light green, quartz-feldspar porphyry of the Bull Creek Formation of Middle - Upper Cambrian age (fig. 1, Table 1). The Bull Creek Formation is composed dominantly of quartz-feldspar porphyry and agglomerate and minor chert and greywacke and is unconformably overlain by 5-20 m of Ordovician Roland Conglomerate. The Roland Conglomerate consists of a terrestrial sequence of pink and white quartz-pebble conglomerate and interbedded quartz sandstone. In the All Nations area, it is 6-8 m in thickness and crops out along a ridge to the south of the mine (fig. 1).

Table 1. STRATIGRAPHIC SUCCESSION IN THE MOINA AREA (after Jennings, 1963; 1979).

Age	Thickness (m)	Unit	Lithology
Quaternary	?		Alluvial sand and gravel.
Tertiary	0-250	Basalt	Olivine basalt.
	0-20	Greybilly	Quartz conglomerate and grit.
	0-100		Sand, clay and gravel.
Devonian		Dolcoath Granite	Biotite granite.
Ordovician	0-600	Gordon Limestone	Limestone (including skarn).
	245	Moina Sandstone	Quartzite and sandstone with minor siltstone, grit and conglomerate.
	0-275	Roland Conglomerate	Quartz conglomerate with minor quartzite and siltstone.
Cambrian	>445	Bull Creek Formation	Quartz-feldspar porphyry.

The Roland Conglomerate is conformably overlain by the Moina Sandstone, which consists of a sequence of interbedded quartz sandstone and siltstone with minor siliceous grit and fine pebble conglomerate. Bedding in the Moina Sandstone dips generally 20°-25° to the north. At Moina, two kilometres west of the All Nations mine, the Moina Sandstone is conformably overlain by the Gordon Limestone, also of Ordovician age, and the Cambrian and Ordovician rocks are unconformably overlain by an extensive cover of Tertiary sediment and basalt.

The Cambrian and Ordovician formations in the All Nations area are part of the southern limb of a broad, open, east-west trending syncline (see Jennings *et al.* 1959; Jennings, 1979), and have been intruded by a stock-like body of Late Devonian biotite granite (the Dolcoath Granite) which crops out on Dolcoath Hill [DQ259064], 1.5 km east of the All Nations mine. Despite its stock-like appearance at the surface, the Dolcoath Granite plunges gradually westward from Dolcoath Hill to extend beneath Moina (Gee, 1966; McKibben, 1971; Collins, 1975). The granite therefore probably occurs at a relatively shallow depth beneath the All Nations mine.

Numerous quartz-wolframite-cassiterite-molybdenite vein deposits and skarn deposits in the Moina-Round Mount district are genetically associated with the emplacement of the Dolcoath Granite (Jennings, 1965; Collins, 1979).

THE ALL NATIONS MINE

Early reports of the All Nations mine were prepared by Twelvetrees (1913), referring to the Lady Barron workings, Reid (1919) and Keid (1943). A detailed investigation of the All Nations mine and the surrounding area was made by Nixon (1954), who also prepared detailed plans of the workings. Development since 1954 is described by Collins (1978), and more recently, Pochins Adit (fig. 2) has been extended in an attempt to trace the narrow veins on which the adit was originally established.

During intermittent production between 1910 and 1942, 28.748 t of tungsten and 0.528 t of bismuth were won from the All Nations mine. In 1978, an additional 2.8 t of wolframite concentrate was produced.

Quartz veins with wolframite and minor cassiterite, bismuth, molybdenite, muscovite, and pyrite penetrate Cambrian and Ordovician rocks in the All Nations area (fig. 1). The veins range up to 400 mm in width, with a general east-west strike and steep south dip (Collins, 1979). At the All Nations mine the veins occur entirely in Ordovician quartz sandstone and siltstone, strike about 100°M, and dip 75°-80°S (fig. 2). The veins occur in an *en echelon* pattern with their extremities overlapping, and at least three parallel veins are recognised with an average thickness of about 200 mm. At the eastern end of the workings the veins have been dislocated by a low angle reverse fault striking about 085°M and dipping 20°-25°N. This thrust fault consists of a brecciated zone with included vein fragments and a series of parallel faults over a thickness in excess of two metres. Slickensides on fault surfaces trend 025°-035°M, and drag on bedding indicates that the hanging wall moved south relative to the footwall (Nixon, 1954). The fault is also reported to have been intersected at the end of a 10 m drive east of the main shaft. The magnitude of the displacement along the fault surface is not known.

DRILLING

The diamond drilling programme was undertaken to test below the reverse fault for vein mineralisation within close proximity to the existing mine. The initial two hole diamond drilling programme, totalling 278.2 m, commenced in February 1980 and was completed in May 1980. The two inclined holes are located on the northern side of the workings, and are collared approximately 30 m apart (figs. 1 and 2). Survey details are given in Table 2. A Pajari was used for down-hole surveys, but orientation measurements are not recorded because of instrument failure.

Table 2. SURVEY DETAILS (\*) OF DIAMOND DRILL HOLES AT THE ALL NATIONS MINE.

DDH	Mine Grid Co-ordinates (†)	Depth (m)	Bearing (Mag.N)	Inclination (degrees)	Elevation (x) (metres)
AN1	1100.92mE 1039.33mN	0	175°	-45	600.5
		84.0	-	-42	
		124.0	-	-42	
AN2	1071.59mE 1029.61mN	0	179°	-40	605.3
		93.5	-	-43	
		146.0	-	-45	

\* Collar positions surveyed by G. Benn, Surveyor, Department of Mines.

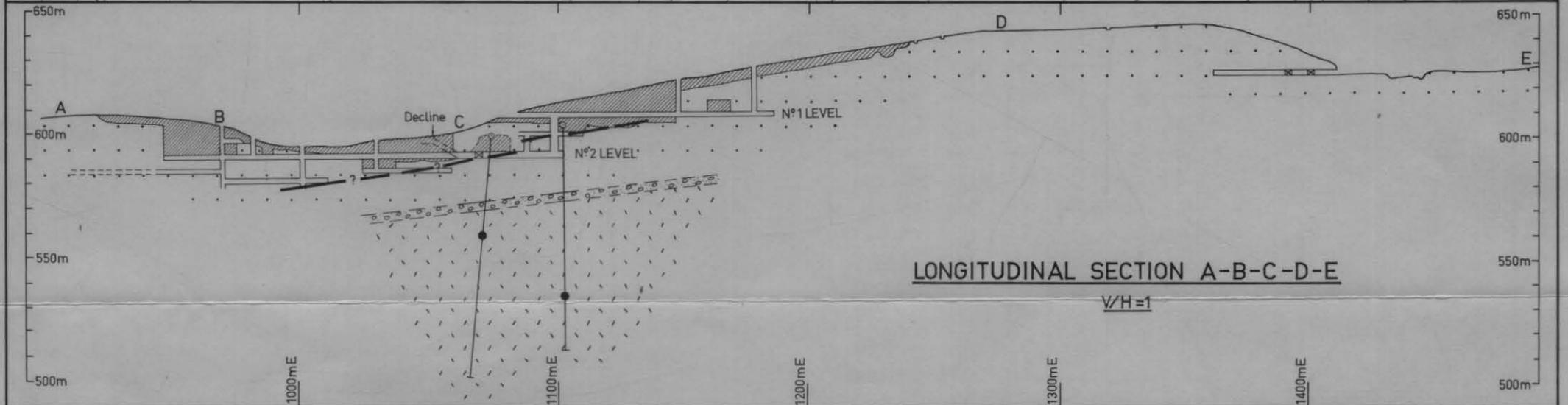
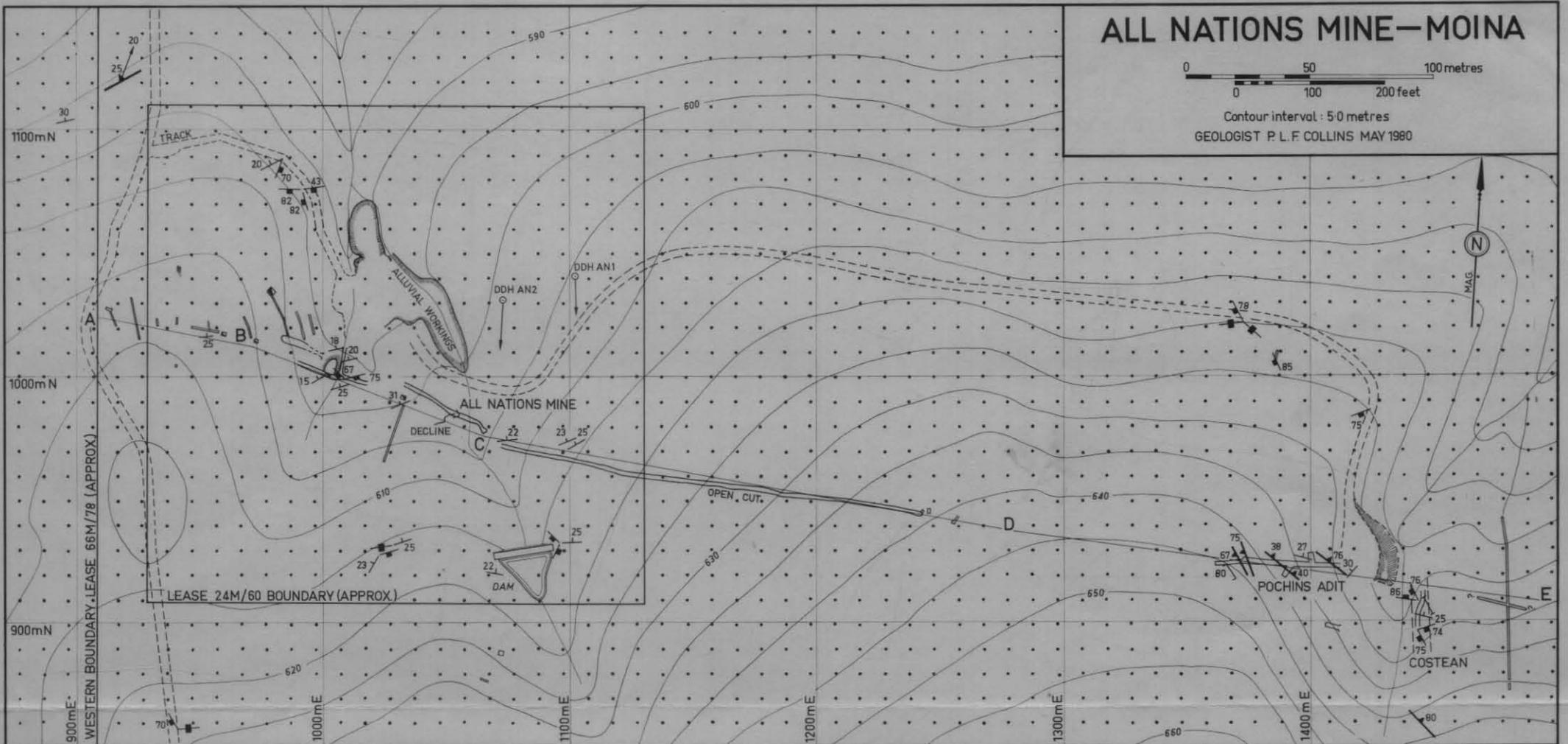
† Refer to Figure 2.

x Elevations relative to an assigned level of 597.0 m at the brace of the shaft (fig. 2).

5 cm

# ALL NATIONS MINE—MOINA

0 50 100 metres  
0 100 200 feet  
Contour interval: 5.0 metres  
GEOLOGIST P. L. F. COLLINS MAY 1980

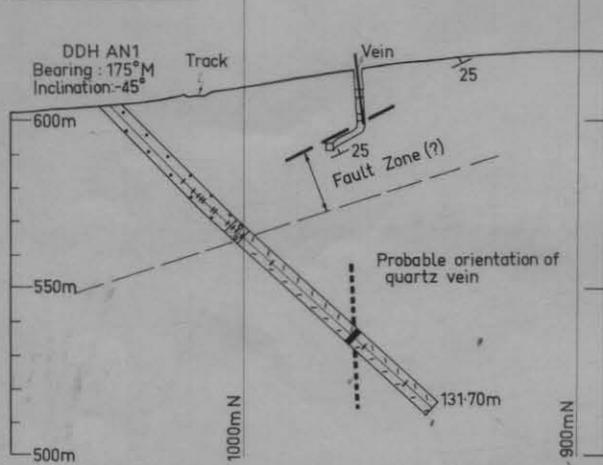


## LONGITUDINAL SECTION A-B-C-D-E

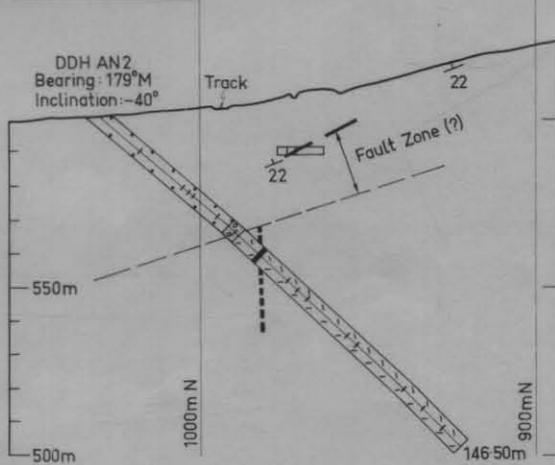
V/H=1

### D.D.H. SECTIONS

#### SECTION 1100mE

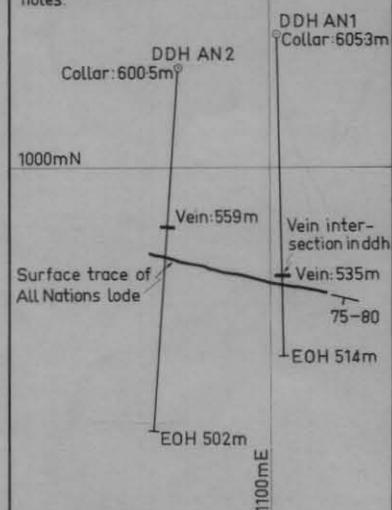


#### SECTION 1070mE



### PLAN

Showing relative positions of surface quartz lode & quartz vein intersections in diamond drill holes.



### LEGEND

- ORDOVICIAN**
- MOINA SANDSTONE (siltstone, quartz sandstone, quartzite, grit, fine pebble conglomerate)
  - ROLAND CONGLOMERATE (coarse pebble conglomerate, minor quartz sandstone)
- CAMBRIAN**
- BULL CREEK FM. (quartz- & quartz-feldspar-porphry)
- Geological boundary  
Bedding  
Joint, vertical joint  
Cleavage, vertical cleavage  
Fault, Stickenside  
Quartz vein  
DDH Intersection

NOTES: Contours based on assigned level of 597.0 metres at the base of the main shaft  
Grid basis is south-west corner of main shaft with assigned co-ordinates 1000mE, 1000mN  
Map & longitudinal section based on Nixon (1954), plan numbers 1306 & 1307

Drawn: H. Mackinnon Dec. 1980

Fig. 2

A grid has been established over the All Nations mine as a reference for plotting and surveying of the drill holes and for possible future development (fig. 1). The reference point for the grid is the south-west corner of the main shaft, with assigned co-ordinates of 1000.0 mE, 1000.0 mN, and an elevation of 597.0 m (see fig. 2). It is proposed to tie the grid into the AMG.

The initial diamond drill hole (AN1) was collared approximately 70 m north of the inclined rise at the eastern end of the underground workings, and drilled south at an inclination of  $-45^\circ$ , to a depth of 131.7 m. A second parallel, inclined hole (AN2) was collared 30 m west of the first hole and drilled at an inclination of  $-40^\circ$  to a depth of 146.5 m (fig. 2). Total core recovery for each hole is approximately 90%, with core loss occurring mainly at fault intersections and in the first 20 m of each hole.

Subsequent to the success of drill holes AN1 and AN2, a further two holes are being drilled, one 100 m to the west and the other 100 m east of the first two holes (drill holes AN3 and AN4 respectively). These are located on the southern side of the workings and are inclined to the north.

## RESULTS

### *Geological data*

Summary geological logs of the drill core are presented below and are illustrated in the sections in Figures 2 and 3. Detailed diamond drill core records are available at the Department.

#### *D.D.H. AN1*

<i>Interval (m)</i>	<i>Width (m)</i>	<i>Recovery (%)</i>	<i>Description</i>
0.00- 50.45	50.45	74	MOINA SANDSTONE. Pale grey-cream quartzite, quartz sandstone, siltstone, shale, siliceous grit, and fine quartz pebble conglomerate. Numerous fault (?) intersections particularly between 31.0-45.0 m, and irregular, thin quartz veins with wolframite occur from 48.5 m.
50.45- 56.05	5.60	100	ROLAND CONGLOMERATE. 'Ghost' conglomerate composed of white-pale grey quartzite pebbles (up to 50 mm diameter) in a pale grey matrix, with minor pale grey quartzite. Faulted boundary between conglomerate and underlying quartz porphyry at 56.05 m.
56.05-109.67	53.62	99	BULL CREEK FORMATION. Pale grey-green quartz porphyry with quartz phenocrysts to 3 mm in a quartzo-feldspathic matrix with minor disseminated pyrite and sphalerite. Numerous quartz and topaz veins up to 25 mm with wolframite and molybdenite. The porphyry is hydrothermally(?) altered at 100.20-100.60 m with chlorite, magnetite, epidote, and calcite.

## D.D.H. AN1 (continued)

Interval (m)	Width (m)	Recovery (%)	Description
109.67-110.36	0.69	97	Quartz vein with wolframite, molybdenite, and tourmaline; and late pyrite (true width = 0.50 m). Silicification and tourmalinisation of the host porphyry extends up to 0.5 m either side of the vein.
110.36-119.40	9.04	100	Quartz porphyry with numerous quartz and topaz veins up to 50 mm with wolframite and molybdenite.
119.40-120.05	0.65	100	Irregularly banded magnetiferous skarn-type hydrothermal alteration, within the porphyry, composed of actinolite, magnetite, garnet, quartz, and carbonate with rare, very fine-grained scheelite.
120.05-131.70	11.65	100	Quartz porphyry with numerous quartz-topaz and quartz-albite veins up to 25 mm with wolframite and molybdenite.

End of hole 131.70 m

## D.D.H. AN2

0.00- 50.35	50.35	75	MOINA SANDSTONE. Pale grey-green quartz sandstone, siltstone, shale and quartzite with minor siliceous grit and fine pebble conglomerate. Numerous faults, particularly between 23.0-37.0 m. Thin quartz veins (up to 80 mm) with wolframite prominent at 39.0-48.5 m.
50.35-54.30	3.95	100	ROLAND CONGLOMERATE. 'Ghost' conglomerate composed of well-rounded, white-grey quartzite pebbles up to 40 mm in a pale grey-pink siliceous matrix. Fault at 53.55 m, and below the fault the conglomerate has a dark grey-red hematitic and siliceous matrix. At 54.0-54.3 m the conglomerate has a green chloritic and argillaceous and in part hematitic matrix which also contains quartz grains of similar habit to the quartz phenocrysts in the underlying porphyry.
54.30- 63.38	9.08	100	BULL CREEK FORMATION. Grey-green massive quartz porphyry with quartz phenocrysts up to 5 mm, and angular lithic and volcanic fragments. Several quartz veins up to 8 mm thick, some with wolframite, and showing alteration zones in the porphyry.

## D.D.H. AN2 (continued)

Interval (m)	Width (m)	Recovery (%)	Description
63.38- 63.79	0.43	90	Quartz vein with wolframite blades, molybdenite and late pyrite (true width = 0.30 m). Narrow alteration zone in the porphyry on either side of the vein.
63.79-128.95	65.16	100	Massive, grey-green quartz porphyry, usually altered adjacent to the numerous quartz-topaz veins (up to 60 mm) with wolframite and molybdenite. Veins are predominant at 79.0-102.5 m. Probable quartz porphyry dyke at 113.55-113.80 m.
128.95-146.50	17.55	100	Coarse, blotchy grey and green porphyry, gradational to a fine-grained quartz-phyric lava(?) from 136.0 m. Quartz veins (up to 15 mm) with wolframite and molybdenite; joints are lined with quartz and molybdenite.

End of hole 146.50 m.

Silicification and tourmalinisation of the porphyry is common adjacent to the numerous quartz-topaz-fluorite-wolframite-molybdenite veins, and in places is relatively extensive in comparison to the width of the veins.

The core was examined in ultra-violet light for the presence of scheelite, particularly in the skarn-type altered sections, but only rare, very fine-grained scheelite was observed in the actinolite-magnetite-garnet section in hole AN1 at 119.40-120.05 m.

The boundary between the sedimentary rock and the underlying porphyry is different in each drill hole. In AN1, there is a definite break at the boundary which is probably a fault with white-pale grey conglomerate and quartz sandstone above the quartz-feldspar porphyry. In AN2, there is a probable unconformable boundary with 0.30 m of conglomerate composed of well-rounded quartzite pebbles in a green chloritic and argillaceous matrix resting upon grey-green quartz-feldspar porphyry. The conglomerate here also contains quartz pebbles of a similar size and habit to the quartz phenocrysts in the underlying porphyry.

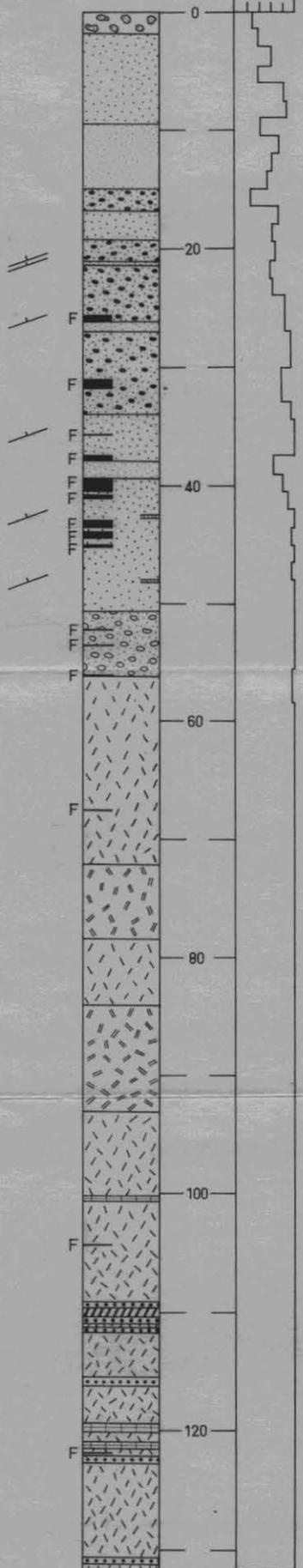
The position of the conglomerate intersections and the bedding to core axis angles are consistent with the general 20°-25° northerly dip of the Ordovician sediments in the All Nations area (fig. 4).

In both drill holes, in the 30 m interval above the sediment/porphyry boundary, there are numerous fault intersections (figs. 2, 3). The top of this faulted interval corresponds with the top of the fault zone exposed in the mine workings. It is proposed that this fault zone extends to the sediment/porphyry boundary, a thickness of about 20 m (fig. 2). The fault zone is probably the result of bedding-plane slip associated with the formation of the east-west trending fold structures in the Cambrian and

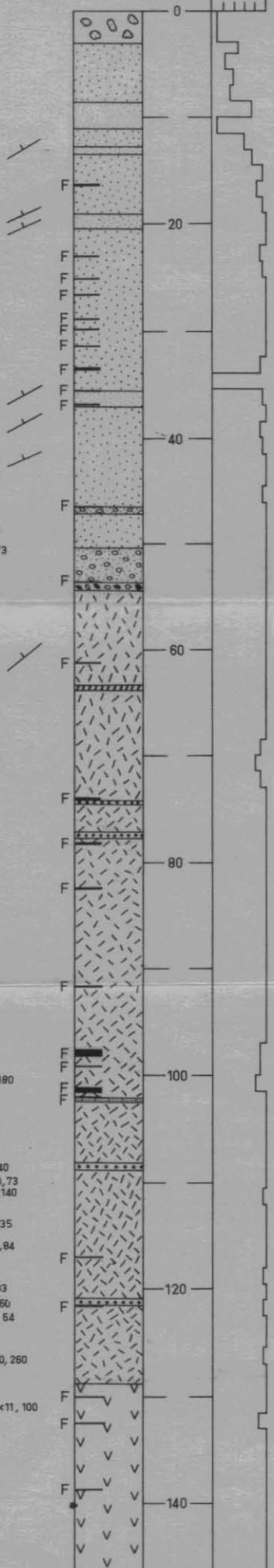
5 cm

D.D.H. AN1

GRAPHIC LOG DEPTH (m) RECOVERY (%) ANALYSES



D.D.H. AN2 GRAPHIC LOG DEPTH (m) RECOVERY (%) ANALYSES



SCHEMATIC SECTIONS OF D.D.H.S. AN1 & AN2, ALL NATIONS MINE—MOINA

GEOLOGIST: P. L. F. COLLINS NOV. 1980

- Soil
- Sandstone boulders
- Quartz siltstone, minor sandstone and grit
- Quartz sandstone and grit
- Quartz grit and fine pebble conglomerate, minor quartz sandstone
- White, pebble conglomerate ("Ghost Conglomerate")
- Red-pink pebble conglomerate
- Quartz-feldspar porphyry
- Decomposed quartz feldspar porphyry
- Quartz-phyric lava (?)
- Quartz vein
- Quartz-tourmaline altered porphyry with quartz-topaz veins
- Magnetite, garnet skarn-type alteration

Angle of bedding to core axis  
F Fault intersection

ANALYTICAL DATA:  
801498 — 569, 100, 36, 140  
Section analysed Analysis — WO<sub>3</sub>, Mo, Bi, Sn (in g/t)

801888 — 711, <5, 34, 361  
801889 — 360, <5, 55, 273

801891 — 1520, 5, 95, 180  
801892 — 807, <5, 34, 140

801893 — 160, <5, 9, 113  
801894 — 207, <5, 12, 86

801895 — 243, 5, 12, 125

801508 — 1390, 81, 520, 41

801509 — 2230, 63, <11, 100

801501 — 2700, 230, 1130, 82

801896 — 4080, 103, <4, 130

801897 — 586, 114, <4, 95

801898 — 1270, 230, 4, 91

801899 — 480, 71, 4, 96

801935 — 289, 7, 4, 516

801900 — 148, 13, <4, 50

801901 — 389, 64, <4, 54

801902 — 186, 173, <4, 72

801511 — 278, 820, 53, 89

801497 — 1.4%, 53, 52, 180

801498 — 569, 100, 36, 140  
801499 — 607, 1690, 720, 73  
801500 — 937, 400, 120, 140  
801501 — 86, 63, 47, 80

801890 — 303, 22, 5, 235  
801502 — 1190, 120, 280, 84

801503 — 148, <19, 13, 93  
801504 — 201, <19, <11, 60  
801505 — 84, 170, <11, 64

801506 — 732, <19, 100, 260

801507 — 4360, 250, <11, 100

801903 — 80, 200, <4, 64  
801904 — 752, 100, <4, 56

Drawn: H. Mackinnon February 1981

Fig.3

b/b

# GEOLOGICAL SECTION—ALL NATIONS AREA, MOINA

SECTION 1100mE (see Fig1 for location) V:H=1



GEOLOGIST P. L. F. COLLINS MAY 1980

14-10

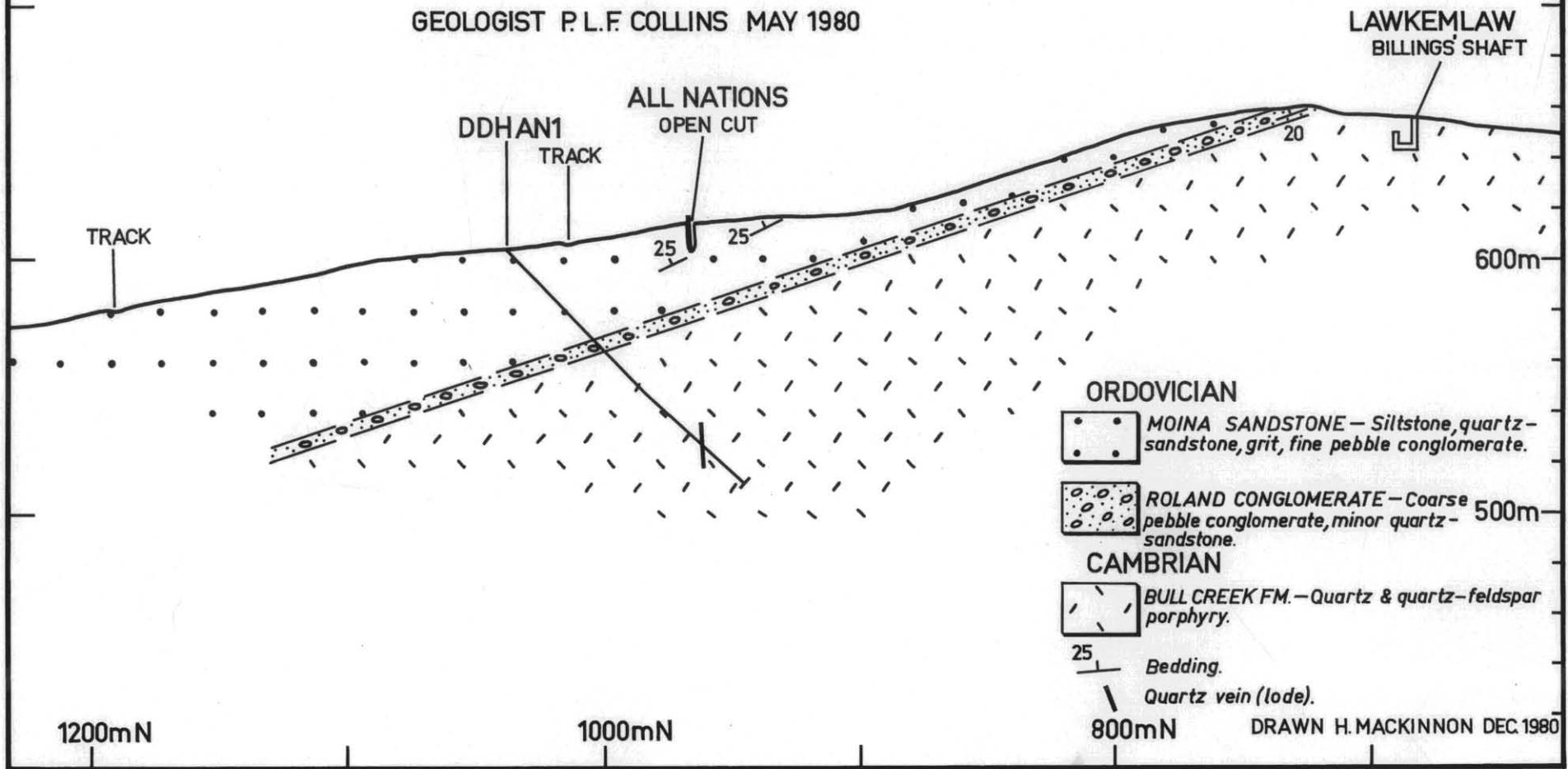
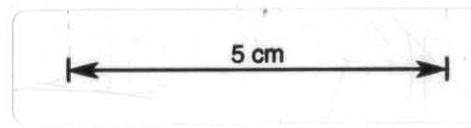


Figure 4.



10/01

Ordovician sequences. During deformation, movement was probably concentrated along the boundary between the two sequences.

*Mineralisation*

The mineralisation intersected in the drill core is divided into three types:

- (i) the two major quartz vein intersections;
- (ii) quartz-topaz and other veins and associated silica and tourmaline alteration of the porphyry; and
- (iii) magnetiferous skarn-type alteration.

*Quartz veins*

The two drill holes encountered significant quartz vein intersections bearing wolframite and molybdenite (and bismuth minerals). Details of each of the intersections are recorded in Table 3 and are illustrated in Figure 2.

Table 3. QUARTZ VEIN INTERSECTIONS IN DIAMOND DRILL CORE, ALL NATIONS MINE, MOINA.

DDH	Depth (m)	Length (m)	VCA*	True width (m)	Elevation† (m)	Mine co-ordinates
AN1	109.67-110.36	0.69	40°	0.50	535.5	1103.5mE, 968.0mN
AN2	63.38-63.79	0.41	45°	0.30	560.0	1069.5mE, 982.5mN

\* VCA - angle of vein intersection to the core axis  
 † Elevation and mine co-ordinates refer to Figure 2.

In drill hole AN1 the vein is composed predominantly of quartz with minor wolframite and molybdenite (and bismuth), and tourmaline as needles in the quartz. Late stage pyrite occurs as a coating on quartz crystals in small vugs. The quartz porphyry adjacent to the quartz vein exhibits silica and tourmaline alteration of the matrix of the porphyry over a core length of 0.5-0.6 m on either side of the vein. The alteration decreases in intensity away from the vein. The quartz phenocrysts in the porphyry are preserved throughout the alteration zone.

In drill hole AN2 the vein consists predominantly of quartz with wolframite blades up to 20 mm long and minor molybdenite (and bismuth) and late pyrite in small vugs. Silicification of the porphyry extends approximately 100 mm either side of the vein, and the lower contact is possibly faulted. There appear to be two types of vein quartz, with the lower 150 mm occurring as clear, crystalline quartz (some showing fine internal growth zones) with pyrite, whereas the upper portion of the vein consists of coarse, milky quartz with wolframite blades.

Assuming that the two vein intersections are of the same vein or vein system, then the probable attitude of the lode is: strike = 115°M, dip 80°-90°S. This attitude acutely transgresses the line of the All

Nations lode which trends 100°M, but it is similar to the lodes at the Lawkewlaw mine (300 m to the south) which trend 110°-115°M and are also in Cambrian porphyry (fig. 1).

*Veined and altered porphyry*

The porphyry intersected in the two drill holes is penetrated by numerous narrow veins of which the following five vein types have been distinguished:

- (1) Quartz-topaz veins up to 80 mm thick with fluorite, clay (after feldspar ?), muscovite(?), tourmaline, wolframite, molybdenite (and bismuth), pyrite, and chalcopyrite. Adjacent to these veins the porphyry usually exhibits a dark grey to brown coloured silica and tourmaline alteration zone which decreases in intensity of alteration away from the vein, but with an abrupt change between the altered and unaltered porphyry. The alteration is similar to the alteration associated with the quartz vein in drill hole AN1.
- (2) Quartz-muscovite veins up to 40 mm in thickness.
- (3) Quartz-chlorite veins up to 5 mm thick and which are earlier than the quartz-topaz veins.
- (4) Quartz-albite veins up to 10 mm thick with molybdenite and minor wolframite. Adjacent to these veins, the porphyry exhibits a narrow pink, albite alteration zone.
- (5) Quartz and molybdenite on joints.

The alteration zones associated with the quartz-topaz veins, which are the most common vein type, are usually very extensive when compared with the thickness of the veins. For example, in drill hole AN1 at 111.30 to 111.75 m, a 6 mm thick quartz-topaz vein (at 45° to the core axis) with wolframite and molybdenite has an associated silica and tourmaline alteration zone extending over 450 mm of drill core.

In contrast to the porphyry, the overlying sedimentary rock contains only a few narrow quartz veins containing wolframite but no visible molybdenite, bismuth, topaz, or albite.

Veining in some sections of the porphyry is particularly well developed. For example, in drill hole AN2 between 78 m and 102 m, there are more than 20 veins ranging from 1 mm - 25 mm in thickness.

*Skarn-type alteration*

In drill hole AN1 there are three intersections of magnetiferous skarn-type alteration. The best developed alteration is between 119.40 m and 120.05 m, where it consists of magnetite, garnet, actinolite, quartz, carbonate, and chlorite, and exhibits an irregular banding at about 30° to the core axis. The skarn-type alteration is cut by a later quartz-albite vein. At 100.20 m to 100.60 m there are thin stringers of magnetite-actinolite within the porphyry which also exhibits silica and tourmaline alteration adjacent to an 8 mm thick quartz-topaz-wolframite vein. The vein is later than the magnetite-actinolite alteration. Also, in the porphyry at 99.90 m to 110.20 m are thin stringers of magnetite. At 121.00 m to 121.55 m are patches of magnetite-actinolite alteration within the

porphyry.

The occurrence of skarn-type mineralisation within the porphyry probably results from metasomatic replacement of thin, lenticular(?) beds of calcareous shale or siltstone, and the irregular banding in the skarn at 119.40-120.05 m may reflect original bedding. Although only 30 m away, drill hole AN2 did not intersect skarn-type mineralisation, which possibly reflects the limited extent of the calcareous beds.

*Analytical data*

The two quartz vein intersections, the silicified and tourmalinised porphyry, and the magnetite-garnet skarn-type altered sections were analysed for Fe<sub>2</sub>O<sub>3</sub>, MnO, and WO<sub>3</sub> as mass%, and Mo, Sn, Bi, Cu, Pb, Zn, Sb, Au, and Ag as grams per tonne (Tables 4 and 5). All samples with less than 1 mass% WO<sub>3</sub> have been re-analysed for tungsten in g/t, and these results are included in Tables 4 and 5.

Sections of the porphyry and of sediments in which veining is relatively well developed have been split as bulk samples and analysed for WO<sub>3</sub>, Mo, Sn, Bi, Cu, Pb, Zn, Ag and Au as g/t (Table 6).

The drill core sections sampled and the WO<sub>3</sub>, Mo, Bi, and Sn analyses are illustrated in Figure 3.

To enable background levels to be established, two samples of the porphyry, which is devoid of veins and alteration, are being analysed.

*Iron and manganese*

The quartz veins are relatively low in iron (3.0 and 2.4 mass% Fe<sub>2</sub>O<sub>3</sub>), most of which occurs as the late pyrite lining vugs and fractures, and some in the wolframite; and are very low in manganese (0.03 mass% MnO).

The veined and altered porphyry has a range of 4.8-7.2 mass% Fe<sub>2</sub>O<sub>3</sub> and 0.15-0.34 mass% MnO.

The magnetiferous skarn-type sections have the highest iron content (7.7-16.6 mass% Fe<sub>2</sub>O<sub>3</sub>) reflecting the presence of the magnetite, and also the highest manganese (e.g. 1.3 mass% MnO in 801503).

*Tungsten*

Tungsten varies from 80 g/t to 1.4 mass% WO<sub>3</sub>. The high tungsten values in some samples (i.e. 801497, 801507, 801509, and 801510) are due to wolframite-bearing veins within the drill core sections sampled.

The quartz veins are relatively low in tungsten (0.06 and 0.14 mass% WO<sub>3</sub>) as expected from the small visible amounts of wolframite in the veins.

The bulk sample sections (Table 6) range from 80-4080 g/t WO<sub>3</sub> and are not consistently high throughout any particular sampled interval.

*Tin*

Tin varies considerably from 41 g/t to 516 g/t, though most samples are less than 100 g/t. There is no relationship between tin and the type of alteration of the porphyry (i.e. skarn or quartz-tourmaline alteration).

Table 4. ANALYSES OF ALTERED AND VEINED PORPHYRY AND OF THE QUARTZ VEIN IN DIAMOND DRILL HOLE AN1, ALL NATIONS MINE, MOINA.

Sample	Fe <sub>2</sub> O <sub>3</sub>	MnO	WO <sub>3</sub>	WO <sub>3</sub>	Mo	Sn	Bi	Cu	Pb	Zn	Sb	Ag	Au	Description	
Reg. No.	Depth (m)	(mass%)	(mass%)	(mass%)	(g/t)										
801497	100.25-100.65	9.1	0.50	1.4	-	53	180	52	39	75	170	<10	<3	<0.3	'Skarn' and quartz-topaz-wolframite vein
801498	109.17-109.67	4.8	0.16	0.06	569	100	140	36	22	29	110	<10	34	<0.3	Altered porphyry adjacent to quartz vein
801499	109.67-110.36	3.0	0.03	0.06	607	1690	73	720	27	45	16	<10	<3	<0.3	QUARTZ VEIN
801500	110.36-110.95	5.1	0.19	0.10	937	400	140	120	20	34	89	<10	<3	<0.3	Altered porphyry adjacent to quartz vein
801501	111.35-111.75	5.1	0.25	<0.01	86	63	80	47	19	60	270	<10	48	<0.3	Veined and altered porphyry
801502	115.70-116.20	5.9	0.28	0.11	1190	120	84	280	12	100	150	<10	<3	<0.3	Veined and altered porphyry
801503	119.40-120.05	16.6	1.3	<0.01	148	<19	93	13	20	<12	120	<10	<3	<0.3	'Skarn' alteration
801504	121.00-121.35	7.7	0.18	0.03	201	<19	60	<11	9	<12	55	<10	30	<0.3	Weakly developed 'skarn' alteration
801505	122.35-122.75	5.1	0.23	<0.01	84	170	64	<11	<8	<12	79	<10	6	<0.3	Veined and altered porphyry
801506	126.30-126.70	6.7	0.27	0.08	732	<19	260	100	25	60	68	<10	<3	<0.3	Veined and altered porphyry
801507	130.80-131.30	4.8	0.18	0.44	4360	250	100	<11	17	<12	60	<10	8	<0.3	Veined and altered porphyry

Analyst: Department of Mines Laboratories, Launceston.

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Table 5. ANALYSES OF ALTERED AND VEINED PORPHYRY AND OF THE QUARTZ VEIN IN DIAMOND DRILL HOLE AN2, ALL NATIONS MINE, MOINA.

Sample	Fe <sub>2</sub> O <sub>3</sub>	MnO	WO <sub>3</sub>	WO <sub>3</sub>	Mo	Sn	Bi	Cu	Pb	Zn	Sb	Ag	Au	Description
Reg. No.	Depth (m)	(mass%)	(mass%)	(mass%)	(g/t)									
801508	63.38- 63.79	2.4	0.03	0.14	1390	81	41	520	17	45	<5	<10	8 <0.3	QUARTZ VEIN
801509	74.20- 74.50	6.4	0.23	0.23	2230	63	100	<11	40	16	60	<10	10 <0.3	Veined and altered porphyry
801510	77.15- 77.70	4.8	0.15	0.29	2700	230	82	1130	20	100	68	<10	5 <0.3	Veined and altered porphyry
801511	108.20-108.80	7.2	0.34	0.02	278	820	89	53	<8	<12	120	<10	5 <0.3	Veined and altered porphyry
801512	121.00-121.50	6.7	0.28	<0.01	126	230	76	20	14	<12	150	<10	89 <0.3	Veined and altered porphyry

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Analyst: Department of Mines Laboratories, Launceston.

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The quartz veins are relatively low in tin (73 and 41 g/t), but in hole AN1 there is an apparent enrichment in tin in the altered porphyry adjacent to the quartz vein (i.e. 73 g/t in the vein and 140 g/t in the adjacent altered host rock).

In the bulk sample sections, tin appears to be more enriched in sediments than in the underlying porphyry (Table 6).

*Molybdenum and bismuth*

The quartz vein in hole AN1 contains appreciable quantities of molybdenum (1690 g/t) and bismuth (720 g/t), and in AN2 contains an appreciable quantity of bismuth (520 g/t).

Molybdenum in the altered porphyry ranges from less than 19 g/t to 820 g/t and bismuth from less than 11 g/t to 1130 g/t. The high values are due to molybdenite and bismuthinite bearing veins within the sampled sections.

In the bulk sample sections there is a marked contrast in molybdenum and bismuth above and below the sediment/porphyry boundary. Sampled sections in the sediments are almost devoid of molybdenum (5 or <5 g/t), whereas in the porphyry, molybdenum ranges from 7 to 230 g/t. In contrast, bismuth appears more enriched in the sediments (9-95 g/t) with the porphyry sections containing up to 5 g/t.

*Copper, lead, zinc, silver, gold and antimony*

The concentrations of these elements are generally consistent and at levels similar to felsic volcanic rocks in Tasmania. The high silver values in samples 801498, 801501, 801504 and 801512 do not have correspondingly high lead concentrations. All antimony values are less than 10 g/t, and all gold values are less than 0.3 g/t.

*Stockwork veining*

Sections of the core in which veining is relatively well developed and which visibly appear the best mineralised sections have been analysed as bulk samples to permit an evaluation to be made of the potential for low-grade stockwork mineralisation. The sections of core split, and the analytical results are listed in Table 6.

The best and most extensive mineralised interval is in hole AN2 between 84.0 m and 100.0 m. The 16 m interval contains more than 12 veins up to 25 mm thick and has an average grade of 0.09 mass% WO<sub>3</sub>, 0.014% Sn and 0.016% MoS<sub>2</sub>.

The molybdenum values are less than expected from visual examination of the core. As the core was split, and not cut with a diamond saw, it is possible that some molybdenite may have flaked off the core during the splitting which would give lower values. All future drill core from the All Nations mine must be cut, not split.

Despite the uncertainty in molybdenum contents, the grades encountered in hole AN2 are sufficiently high to warrant further investigation of the stockwork potential.

Table 6. ANALYSES OF STOCKWORK VEINING IN DIAMOND DRILL HOLES AN1 AND AN2, ALL NATIONS MINE, MOINA.

Reg. No.	Sample		WO <sub>3</sub> (g/t)	Mo (g/t)	Sn (g/t)	Bi (g/t)	Cu (g/t)	Pb (g/t)	Zn (g/t)	Ag (g/t)	Au (g/t)	Rock type
	D.D.H.	Depth (m)										
801888	AN1	47.5- 49.5	711	<5	361	34	<4	<3	8	<3	<0.3	Quartz sandstone
801889		49.5- 51.5	360	<5	273	55	<4	17	7	<3	<0.3	Quartz sandstone
801890		112.5-115.5	303	22	235	5	5	7	44	<3	<0.3	Quartz porphyry
801891	AN2	38.0- 40.0	1520	5	180	95	<4	25	<3	<3	<0.3	Quartz sandstone and siltstone
801892		40.0- 42.0	807	<5	140	34	<4	5	4	<3	<0.3	Quartz sandstone and siltstone
801893		45.0- 47.0	160	<5	113	9	<4	<3	7	<3	<0.3	Quartz sandstone
801894		47.0- 49.0	207	<5	86	12	<4	<3	3	<3	<0.3	Quartz sandstone
801895		51.5- 53.5	243	5	125	12	9	6	6	<3	<0.3	Conglomerate
801896		84.0- 86.0	4080	103	130	<4	4	<3	26	<3	<0.3	Quartz porphyry
801897		86.0- 88.0	586	114	95	<4	4	<3	15	<3	<0.3	Quartz porphyry
801898		88.0- 90.0	1270	230	91	4	4	<3	37	<3	<0.3	Quartz porphyry
801899		90.0- 92.0	460	71	96	4	<4	12	29	<3	<0.3	Quartz porphyry
801935		92.0- 94.0	289	7	516	4	<4	16	35	<3	<0.3	Quartz porphyry
801900		94.0- 96.0	148	13	50	<4	<4	7	25	<3	<0.3	Quartz porphyry
801901		96.0- 98.0	389	64	54	<4	<4	7	21	<3	<0.3	Quartz porphyry
801902		98.0-100.0	186	173	72	<4	<4	6	29	<3	<0.3	Quartz porphyry
801903		140.0-142.0	80	200	64	<4	<4	8	20	<3	<0.3	Quartz-phyric lava(?)
801904		142.0-144.0	752	110	56	<4	26	29	30	<3	<0.3	Quartz-phyric lava(?)

Analyst: Department of Mines Laboratories, Launceston.

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SUMMARY AND CONCLUSIONS

A two-hole exploratory diamond drilling programme at the All Nations mine has indicated a significantly thick quartz vein bearing wolframite, molybdenite and bismuthinite occurring within Cambrian quartz and quartz-feldspar porphyry. The porphyry contains numerous other wolframite and molybdenite-bearing quartz and quartz-topaz veins (1-80 mm thick) and also contains narrow bands of magnetite and garnet skarn-type alteration. In the overlying Ordovician sediments, which are host to the All Nations lode, there are only a few narrow quartz veins with wolframite.

The two vein intersections (0.5 m and 0.3 m true width) occur almost directly beneath the All Nations lode which is 0.2-0.3 m thick, trends 105°M and dips 75°-80°S. Assuming that the two drill hole intersections are of the same vein system, the lode in the porphyry strikes 115°M and dips 80°-90°S.

The vein intersections are considered to be of a different vein system than the All Nations lode because:

- (i) The vein system intersected in the drill holes has a different attitude to the All Nations lode.
- (ii) There is a marked increase in the number of veins in the porphyry compared with the overlying sediments.
- (iii) The mineralogy of the veins in the porphyry is different to the veins in the sediments.

It is concluded that the two vein systems have been faulted into approximate juxtaposition with the lower (new) vein system trending more north of west than the All Nations lode. This trend is parallel to other nearby vein systems within the Cambrian porphyry (e.g. Lawkemplaw mine).

The low angle reverse fault which caused the relative displacements of the two vein systems occurs as a fault zone or series of faults, up to 20 m in thickness and dipping 20°-25°N, with a major break at the boundary between the porphyry and the overlying sediments. The new vein system is probably only located within the porphyry.

The occurrence of bands of skarn-type mineralisation and of numerous, narrow veins bearing wolframite and molybdenite within the porphyry indicates the porphyry is also a potential host for low-grade tungsten, molybdenum, or tin mineralisation.

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[19 March 1981]