PROPOSED DRILLING BETWEEN STOREY'S CREEK AND ABERFOYLE

by J. Baird.

SUMMARY

Recent investigations in the Storey's Creek-Aberfoyle area suggest that Eastern Hill is the best prospect, and proposals are made for diamond drill holes to intersect the extensions down dip of outcropping quartz veins.

INTRODUCTION

The two mines of Aberfoyle and Storey's Creek are now under one management, which wishes to initiate a comprehensive diamond drilling campaign within and around its leases. Though the surface of the area has been prospected extensively during the past eighty years, only a limited amount of diamond drilling has been done. Fifteen drill holes from the surface have been completed on the Aberfoyle leases during the past ten years but there is no record of any surface drilling on the Storey's Creek leases.

LOCATION.

The area investigated is in the country of Cornwall and comprises portions of the leases held by Aberfoyle Tin N.L. and Storey's Creek Tin Mining Co. N.L., together with the country between them. This area is portion of a plateau from 2900 to 1900 feet above sea level. The mine at Storey's Creek is two miles north-west of the Aberfoyle mine, and four hundred feet higher.

GENERAL GEOLOGY

Since 1927 a number of geological reports have been written about various aspects of this mining field, the most recent being that of Blissett (1959) who gives details of the geology and history of exploration in the Rossarden-Storey's Creek district, together with numerous recommendations for drilling the various prospects.

MINING OPERATIONS

Mining operations have been confined to the exploitation of quartz veins containing cassiterite and wolfram. These veins occur in folded and faulted slates and quartzites of the Mathinna Group of probable Silurian age. The Mathinna rocks outcrop intermittently over a large portion of the area under review, but are covered by flat-lying Permian sediments around the Aberfoyle mine and west of Storey's Creek, by Tertiary gravels north-west of Aberfoyle, and by dolerite scree north of Storey's Creek. The Ben Lomond granite outcrops along the south-west of this zone of Mathinna rocks, and is regarded as a possible source of the tin and tungsten mineralisation.

The vein system at the Aberfoyle mine has been described in detail by R. J. P. Lyon (1957), and the mineralisation in the veins by A. B. Edwards and R. J. P. Lyon (1957).

SOURCE OF MINERALIZATION

The quartz veins in which cassiterite and wolfram occur, are believed to originate from aplite apophyses from the Ben Lomond granite. The aplite was first encountered in Spier's Shaft at Aberfoyle, at 1050 feet below surface. A similar occurrence of aplite has recently been discovered by diamond drilling below No. 8 level at Storey's Creek mine; the highest point of this aplite apophysis so far proved is 600 feet below surface, that is 850 feet higher than the aplite at Aberfoyle.

Specimens were collected from the margin of the Ben Lomond granite on the Mammoth workings at Nisbet Creek about half a mile south-west of the Storey's Creek mine. These specimens were compared with aplite from drill hole U81 of Storey's Creek mine, and with aplite from No. 10 Level, Aberfoyle mine.

G. Everard, Mineralogist and Petrologist, describes these rocks thus:—

"*Aplite from Storey's Creek mine, Drill hole* U81 *at* 246' 6".

Medium-grained granular, pale greenish-grey rock, containing quartz and a greenish sericite. The specimen is sparsely mineralised with sphalerite and chalcopyrite.

In thin section the rock consists of irregular grains of quartz with lath-lake inclusions of fresh albite. White mica is common in somewhat ragged plates, and albite is also common along grain boundaries and in intergranular spaces. Quartz grains are cris-crossed with lines of bubbles and fine grained pyrite occurs in veinlets and aggregates.

Aplite from Aberfoyle mine, No. 10 *Level.*

Pale grey medium to fine-grained rock, mineralised by small, very sparsely disseminated aggregates of chalcopyrite, bornite and galena.

In thin section the rock consists of irregular quartz grains and books of white mica. An occasional small crystal of albite occurs in the quartz veins. Opaque sulphides appear occasionally in cleavages.

This specimen differs from the Storey's Creek specimen in a somewhat finer granularity, and the all but complete absence of albite.

'*Margin of Granite' from Nisbet Creek.*

Medium-grained pale grey rock containing granular quartz, white mica and a little tourmaline in black acicular crystals, flanked by a mass of pale yellowish-green mica in plates up to about 5 mm. across; on the other side the rock is composed entirely of massive yellowish-green mica in microscopic flakes.

In thin section the pale grey rock consists of granular quartz shattered by a very fine network of irregular cracks. There is a little interstitial mica and occasional crystals of tourmaline.

Except for the shattering of quartz grains, the rock is similar to the Aberfoyle aplite. The rock is actually a greisenised aplite".

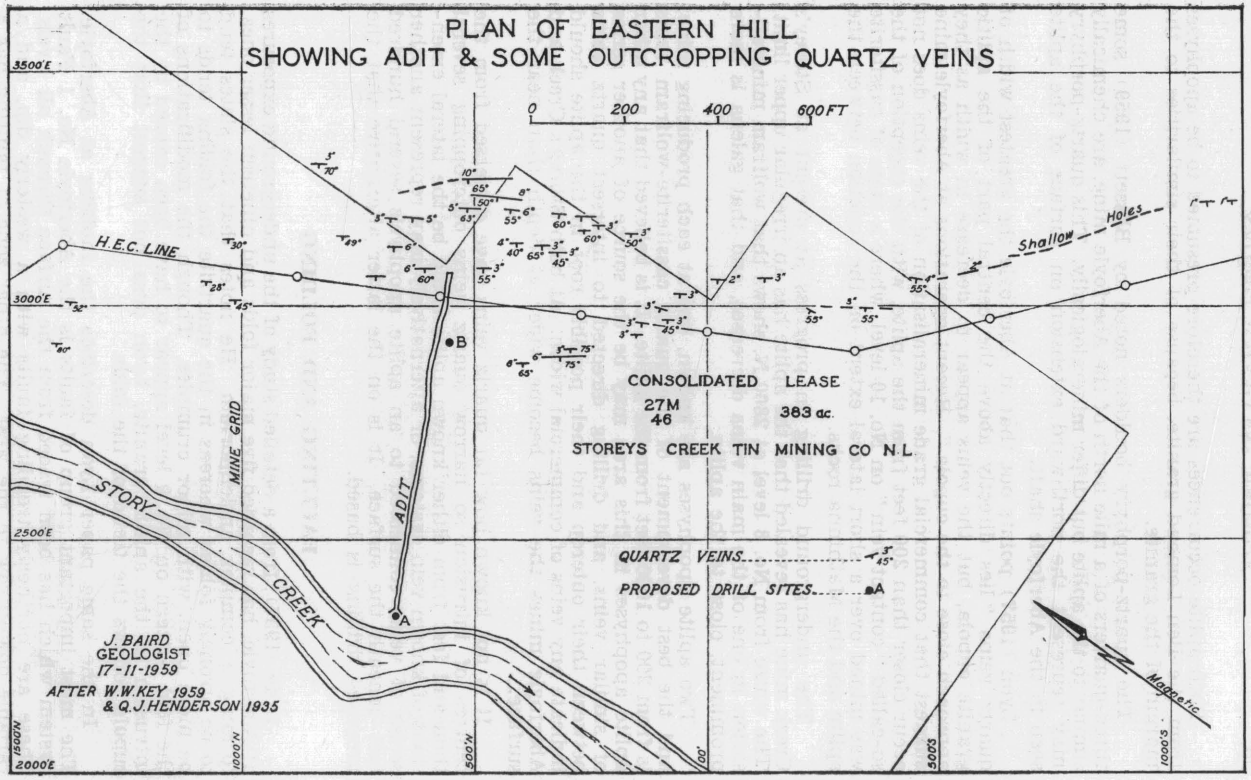
PLAN OF EASTERN HILL
SHOWING ADIT & SOME OUTCROPPING QUARTZ VEINS
0 200 400 600 FT
3500'E
3000'E
2500'E
2000'E
1500'N
1000'N
500'N
500'S
1000'S
H.E.C. LINE
Shallow Holes
CONSOLIDATED LEASE
27M
46
383 ac.
STOREYS CREEK TIN MINING CO N.L.
ADIT
STORY
CREEK
MINE GRID
QUARTZ VEINS
PROPOSED DRILL SITES
A
B
Magnetic
J. BAIRD
GEOLOGIST
17-11-1959
AFTER W.W.KEY 1959
& Q.J.HENDERSON 1935
5 cm

FIGURE 16.

Both aplite occurrences are therefore presumed to be apophyses from the Ben Lomond granite, because of their similarities to the margin of the granite.

The quartz-porphyry boulders noted by Blissett (1959) some three-quarters of a mile north of the Aberfoyle mine, are chemically similar to the aplite but differ mineralogically. This quartz-porphyry may represent the northward extension on surface of the aplite seen in the Aberfoyle shaft.

Lyon (1957) points out that at Aberfoyle the greatest width of quartz veins " lies directly above the central part of the aplitic granite cupola, but the veins appear to decrease in width as they approach close to the cupola ". Recent operations at Aberfoyle mine suggest that commercial grade mineralisation of the veins does not occur closer than 200 feet from the aplite, with the exception of the so-called " contact vein " on No. 10 level, where a mass of cassiterite was mined over a short lateral extent on the junction between the aplite and the Mathinna rocks.

The underground drilling in progress at present at Storey's Creek mine has revealed that the aplite has an irregular upper limit. The winze from No. 8 level at 2800 N. shows that wolfram mineralisation in one of the main veins decreases, and that galena is more prominent, close to the aplite.

Two aplite apophyses are known, one at each producing mine, and the best development of the quartz cassiterite-wolfram veins is from 200 to 1000 feet from the aplite. It is believed that any other aplite apophyses in this area may be the source of another series of similar veins, and drilling directed to intersect quartz veins between their outcrop and their possible root in the aplite should indicate any veins of commercial width. At both Storey's Creek and Aberfoyle mines the veins become wider at depth than near the surface.

It is not known how far quartz veins have dispersed from the centres of intrusion so narrow quartz veins outcropping several thousand feet from either known aplite could be the lateral extensions of known vein systems, or alternatively may represent another series of veins connected to an aplite apophysis several hundred feet beneath the surface. It is on the latter alternative that the proposed drilling is based.

FAULTING AND FOLDING

Lyon (1957), from a detailed study of the underground exposures at Aberfoyle, has recorded five major folds and nineteen lesser ones, forming a complex anticlinorium. He notes that the slates tend to be strongly folded whereas in the quartzite the folding tends to be more open, with minor crumples. Though the modifications of the fold pattern on No. 9 level appear to have been caused by the intrusion of the aplitic granite, Lyon does not suggest that the cupola follows the trend of the folds.

In the same paper Lyon describes the faulting at Aberfoyle. The most important group of faults is the Aberfoyle No. 1 Fault System which has been traced from the surface through all levels. These are northerly trending faults with a westerly dip, and a variable downthrow to the west. The other zone of faulting has a north-west trend, parallel to the fold axes of the sediments and

has a steep south-westerly dip. Lyon states that both the Aberfoyle fault and the cross faults were initially pre-ore, and produced fractured channel ways for the emplacement of the quartz veins. Further movement along these faults occurred after mineralisation.

Blissett (1959) mapped the underground workings and the surface at Storey's Creek mine. He states that the Mathinna beds are closely folded along north-westerly axes, with limbs generally dipping at over 60°. Though the main Aberfoyle fault trend is present on a minor scale, the commonest faults at Storey's Creek are small north-westerly ones. The majority show post-ore movement which displaces the veins. Blissett states that the veins fill zones of weakness in the sediments, and strike in the general direction of the country rock, but often cut across steeply dipping bands of quartzite and slates.

VEIN SYSTEMS

At Aberfoyle nine veins, in five groups, have been recognised by Lyon. They occur in a "sheeted" zone, about 200 feet wide, with a north strike length of 1600 feet. The veins dip to the west, usually at angles between 50° and 60°. Some attain a width of over five feet, but veins are customarily mined down to a width of twelve inches. Edwards and Lyon (1957) describe the veins as "typically banded, with a selvedge of mica from 0·1 inch to 1 inch wide on each wall. Coarse crystals of cassiterite and wolfram, and patches of sphalerite occur on the insides of the selvedges, projecting into a central core of quartz of varying width. Other sulphide minerals are present in the interstices of these minerals, forming the central part of some narrow veins, and occurring as clots of sulphides in the quartz cores where the veins are wider".

Three vein systems are recognised at Storey's Creek mine. The main veins branch and join together again both along strike and down dip. Nos. 1 and 2 veins outcrop at the surface, but the highest point of No. 3 (the footwall vein) occurs at No. 4 level. The veins strike north-west and dip to the south-west at angles usually less than 45°. Vein width is frequently over five feet.

The mineralisation in the veins at Storey's Creek mine differs from that at Aberfoyle in the proportion of wolfram to cassiterite. Tin concentrate is still the major product at Aberfoyle, but Edwards and Lyon (1957) show how the wolfram to tin ratio has increased with mining from the lower levels. No wolfram has been recorded from above No. 5 level at this mine.

Wolfram is the most important mineral in the Storeys' Creek veins, and production figures from this mine also show an increasing ratio of wolfram to tin in the concentrates with mining from the lower levels. Owing to the patchy nature of the distribution of the ore minerals in the quartz veins, accurate sampling is difficult; and, because of the absence of regular underground sampling, the variations in grade of particular veins cannot be stated exactly at either mine.

At Aberfoyle the sulphide minerals constitute about 3·5% of the vein material (Edwards and Lyon, 1957). The most abundant of these sulphides are pyrite, chalcopyrite and sphalerite. Edwards and Lyon do not use the term "marmatite" in describing the sphalerite, but state that "analyses of samples of sphalerite . . . indicate that the sphalerite is of uniform composition throughout

the mine, containing approximately 13% iron, which in the main substitutes for zinc ". As marmatite may contain up to 20% iron, usage of the term at Aberfoyle appears justified. This marmatite bears a superficial resemblance to wolfram, and the two have been confused when in situ underground.

A similar dark mineral occurring in the veins at Storey's Creek mine has been called " martite " (Reid and Henderson, 1929). Specimens of this mineral appear to be identical with the Aberfoyle marmatite, and there is no reason for continued use of the term " martite " unless further testing can prove the occurrence of this variety of haematite.

PROSPECTS—EASTERN HILL

Blissett (1959) has made recommendations on all the outstanding prospects in the area. Of these, Eastern Hill is the most obvious site for immediate drilling. This hill is on the eastern side of Story Creek, and rises some 250 feet above creek level. The intermittent outcroppings of a number of narrow quartz veins (up to 10 inches wide) over a strike length of 2000 feet along Eastern Hill suggests that veins of commercial width could occur at depth. The outcrops are mainly on the old lease 9584/M held by E. R. Egan, which now forms the eastern part of Consolidated Lease 27M/46 held by Storey's Creek Tin Mining Co. N.L.; the remaining outcrops are near the eastern boundary of that lease.

On the surface of Eastern Hill there are a number of narrow veins of quartz striking between 320° magnetic and 340° magnetic, with dips varying between 40° and 75° to the south-west. The north-west strike of the veins and the absence of known strong faulting suggest a vein pattern similar to that at Storey's Creek mine. Most of the veins are less than six inches in width but vary along strike and probably the widest parts have been extracted by prospectors. Workings on the hill extend over an area 2000 feet by 400 feet, and include at least two small shafts, now filled with water, and a number of trenches. Some of these trenches are over ten feet deep, but the majority are three to four feet deep. They seldom continue unbroken for more than fifty feet. It is possible that several tons of tin ore have been mined from these workings; small specimens of quartz showing cassiterite mineralisation are common on the old dumps.

The extension of these veins to the north-west would be in the footwall of the veins being worked at Storey's Creek mine. Blissett (1959) has suggested diamond drilling into the footwall from the upper levels of the mine to seek veins of this nature. These drill holes would need to be some distance from the aplite to be a satisfactory test.

The workings on Eastern Hill were the subject of a report by Henderson (1936).

He recommended a series of five declined drill holes to test the veins at a vertical depth of 250 feet. Those holes were not drilled, and it is now suggested that deeper holes would be better, because of the small amount of quartz showing in an adit into the hill.

This old adit was cleaned out and mapped in detail. The adit is 725 feet long, and begins from the east bank of Story Creek about 800 feet upstream of its junction with Nisbet Creek. The bearing of the adit is 063° magnetic, which takes it under the swarm of

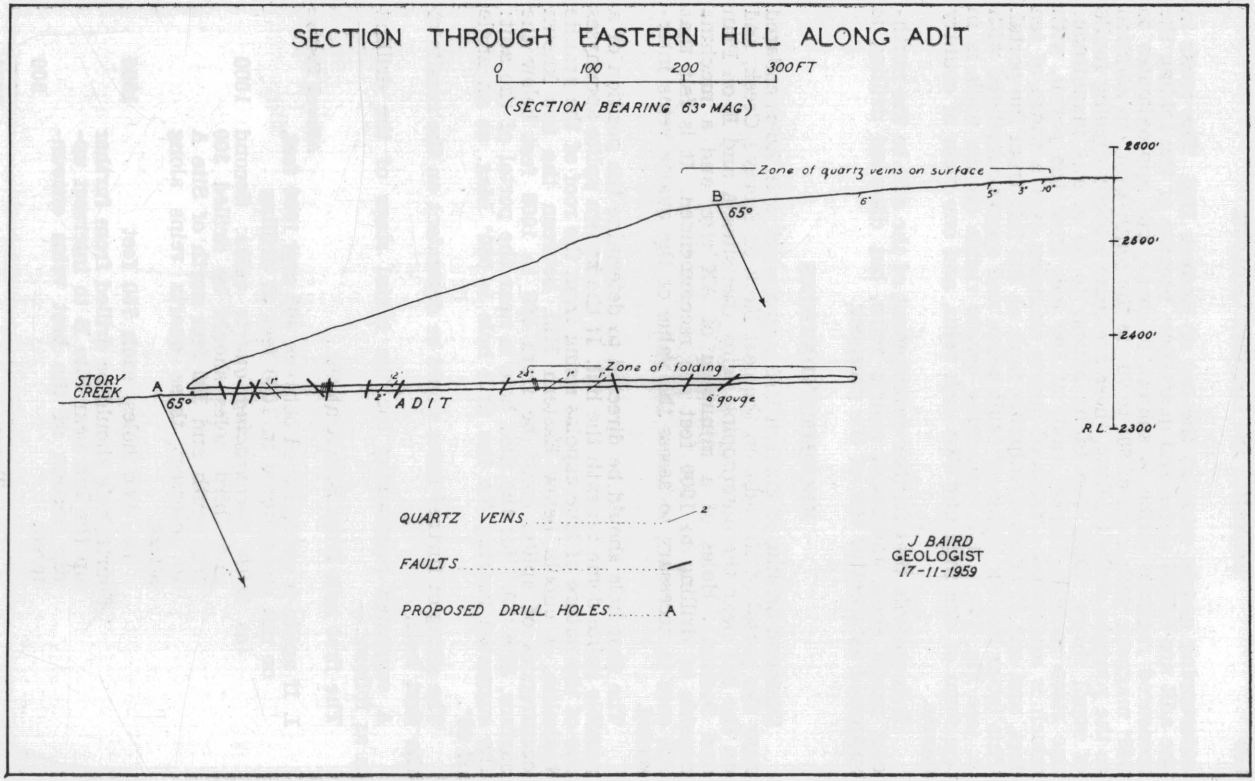
SECTION THROUGH EASTERN HILL ALONG ADIT
0 100 200 300FT
(SECTION BEARING 63° MAG)
Zone of quartz veins on surface
B
65°
6'
3'
5'
10'
2600'
2500'
2400'
R.L 2300'
STORY CREEK
A
65°
1"
2'
2'
ADIT
24'
1"
Zone of folding
6 gouge
QUARTZ VEINS
FAULTS
PROPOSED DRILL HOLES A
J BAIRD
GEOLOGIST
17-11-1959
5 cm

FIGURE 17.

outcropping quartz veins at the top of Eastern Hill. The rocks in the adit are folded slates and quartzites; because of the folding the measured regional strike is subject to error, but approximates to 345° magnetic with a dip of 60° to 70° to the south-west. In addition to the younger strike faulting, there are some easterly dipping faults of small throw. Only two faults appear to be of any magnitude: one steep easterly-dipping fault at 160 feet from the portal, with which is associated a mass of quartz stringers over a width of ten feet, and one 37° easterly-dipping fault at 590 feet from the portal. This latter has six inches of fault gouge and quartz associated with it (see Fig. 17). The remaining quartz visible on the walls is in the form of one inch and two inch veins, and one mass of country quartz.

It is possible that further development of the adit to the north-east would show additional quartz veins, but diamond drilling is suggested as a better test of the prospect.

RECOMMENDATIONS

Diamond drilling of Eastern Hill is suggested, with holes collared near the portal of the adit on the east bank of Storey's Creek, and on the hill near the outcropping veins (see sites A and B on Plan and Section). Holes of a minimum of AX size, and a machine capable of drilling to 1000 feet are recommended. It is felt that AX core is necessary to assess the value of the quartz veins intersected.

The first hole should be directed to determine the position of a possible aplite dome beneath the hill. If the known aplite apophyses are of the nature of true cupolas rising from the roof of the granite batholith, a cupola below Eastern Hill, between the two known occurrences of aplite, could be from 500 to 1000 feet below the surface, Site "A" for the first hole is near the portal of the adit: the suggested bearing for the drill hole is 060° Mag. at an angle of 65°.

The siting of further holes would be dependent on the results of the first hole.

A suggested programme for the initial stage of the drilling is as follows:—

The first hole from Site A at 65°.

	Allowed Footage
I. If aplite is encountered between 400 and 1000 feet, or not encountered in 1000 feet of drilling	
(a) *With encouraging quartz veins*: Second and third holes should be drilled 300 feet south and 300 feet north of Site A to intersect these quartz veins along strike.	1000
i.e., two holes, each 750 feet	1500
Fourth hole should be drilled from further up the hill near Site B to intersect up-dip portion of the best veins encountered.	500
TOTAL	3000

	Allowed Footage
(*b*) with no appreciable quartz veins. Second hole should be drilled from Site B at —65° and also taken to 1000 feet.	1000
	1000
Third and fourth holes should be drilled 300 feet south and 300 feet north of Site B to intersect the extensions along strike of the best veins encountered in the second hole.	1000
	1000
TOTAL	3000
II. *If aplite is encountered in first* 400 *feet of first hole*: Second hole should be drilled from Site B at —65° for about 600 feet.	400
	600
Third and fourth holes should be drilled 300 feet south and 300 feet north of Site B to intersect the extensions along strike of the best quartz veins encountered.	1000
TOTAL	2000

In all, an initial programme of four holes, totalling 2000 to 3000 feet of drilling, is proposed.

Drilling from the adit is not suggested at present because of the cost of equipping the adit with air, water and ventilation pipes, and of the necessity for further excavations if holes other than almost horizontal ones are to be drilled.

ACKNOWLEDGMENTS

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