

THE SEARCH FOR IRON, LEAD, AND GOLD IN DOUGLAS BAY, ISLE OF MAN

OLD MINING TRIALS AND NEW INSIGHT INTO THE GEOLOGY

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**Abstract:** N-S lead veins and NW-SE iron veins were investigated by 19th century miners in the vicinity of Douglas, Isle of Man. Recent explorations of surface remains have given further details - particularly of vein materials. Analysis of all the available evidence leads to the conclusion that a zone of mineralisation extends approximately northwards from the south end of Douglas Bay with the centre of mineralisation located in the vicinity of Onchan Head.

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INTRODUCTION

The first sight many people have of the Isle of Man is of a range of hills rising out of the sea as the boat approaches Douglas. Several features stand out, including the lighthouse on the headland at Maughold, and a similar one at Douglas. At both sites, the cliffs are over forty metres high, and the resulting scenery is dramatic. The reason for these cliffs lies in the Caledonide mountain-building episode which raised Cambro-Ordovician slates to form the range of hills visible from the sea. Later on, during Permian times, both areas of slate received mineralisation as tension cracks appeared. The iron mines at Maughold are reasonably well-known, but the iron, lead and gold veins a few kilometres both north and south of Douglas have largely been forgotten. This article details the geology of the region near Douglas, and the mineralisation of the area. The history of the mines there is outlined.

GEOLOGY AND MINERALISATION

The Manx Slates are Cambro-Ordovician (Lamplugh 1903), some debate having taken place about their exact age (Molyneux 1979; Simpson 1963a,b; Simpson 1964; Helm et al. 1963). The period of uplift seems to have been Devonian, the time in which the Caledonide granites in Foxdale and Laxey (Isle of Man) were emplaced (Ineson and Mitchell 1979). A NE-SW double chain of hills is the present day expression of that uplift. Later, probably in Permian times, mineralisation, mainly lead and zinc, but with some iron, copper, and silver, took place on two sets of veins almost at right angles to each other, running N-S and E-W (Lamplugh 1903; Ineson and Mitchell 1979). A much later, Tertiary, event was the emplacement of olivine-dolerite dykes (Lamplugh 1903; Ineson and Mitchell 1979). Lamplugh found that these were in places associated with "ironstone", probably umber or ochre. The iron veins trend NW-SE, at right angles to the Caledonide folding axis. These two episodes of mineralisation give rise to mineral lodes just north and south of Douglas.

ORE VEINS AND THEIR MINES

The map (Fig.1) shows the main features of mining and mineralisation in Douglas Bay. The dotted lines are added to show the author's opinion of where the lead-bearing lodes strike. At its northernmost end, at Onchan Head, the present electric tramway sheds and Summerland site conceal adits of the Douglas Bay mine (Plate 1). Further east, several trials listed by Lamplugh (1903) explored weakly developed veins. On Douglas Head, the ruins of a mine, and the shaft, can be seen (Plate 2). The southernmost end of one lode is at Stack Indigo in a steep gully, below the coast road called the Marine Drive. The lode continues through a mine on Douglas Head to a small quarry overlooking Douglas. The iron mineralisation is manifest at several points south of Douglas Head, as stained cracks in the cliffs. One is a lead mine at Wallberry (locally known as Horse's Leap), where continual landslips of the highly contorted slates have now closed the road to vehicles. Another is at Billy Gilbert's Harbour (Fiddler's Green) where a small iron mine exists (Fig.2; Plate 3).

MINES SOUTH OF DOUGLAS

Figure 2 is based on the 1876 six inches to one mile O.S. map, and shows the main localities of interest south of Douglas. Figure 3 shows the main lode of the area in detail. Its northernmost end seems to be only manifest by a few iron-stained cracks in a quarry close to the site of Fort Anne hotel. Along the lode, in a direction approximately

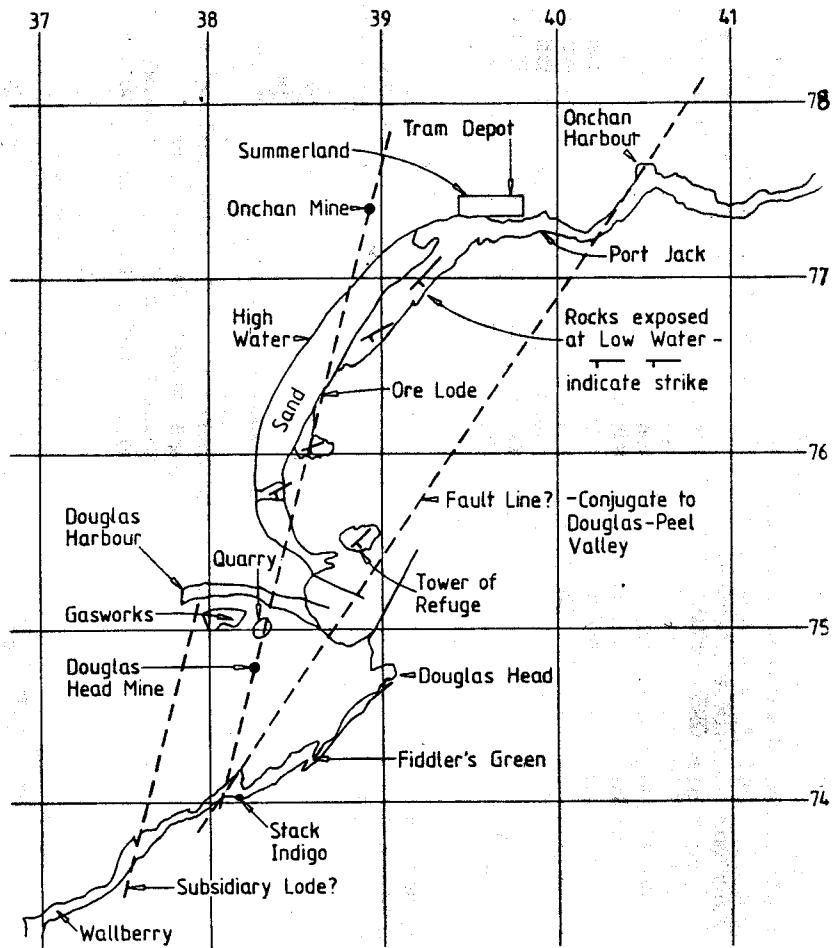


Fig.1. Douglas Bay, Isle of Man, and the mines and ore lodes.

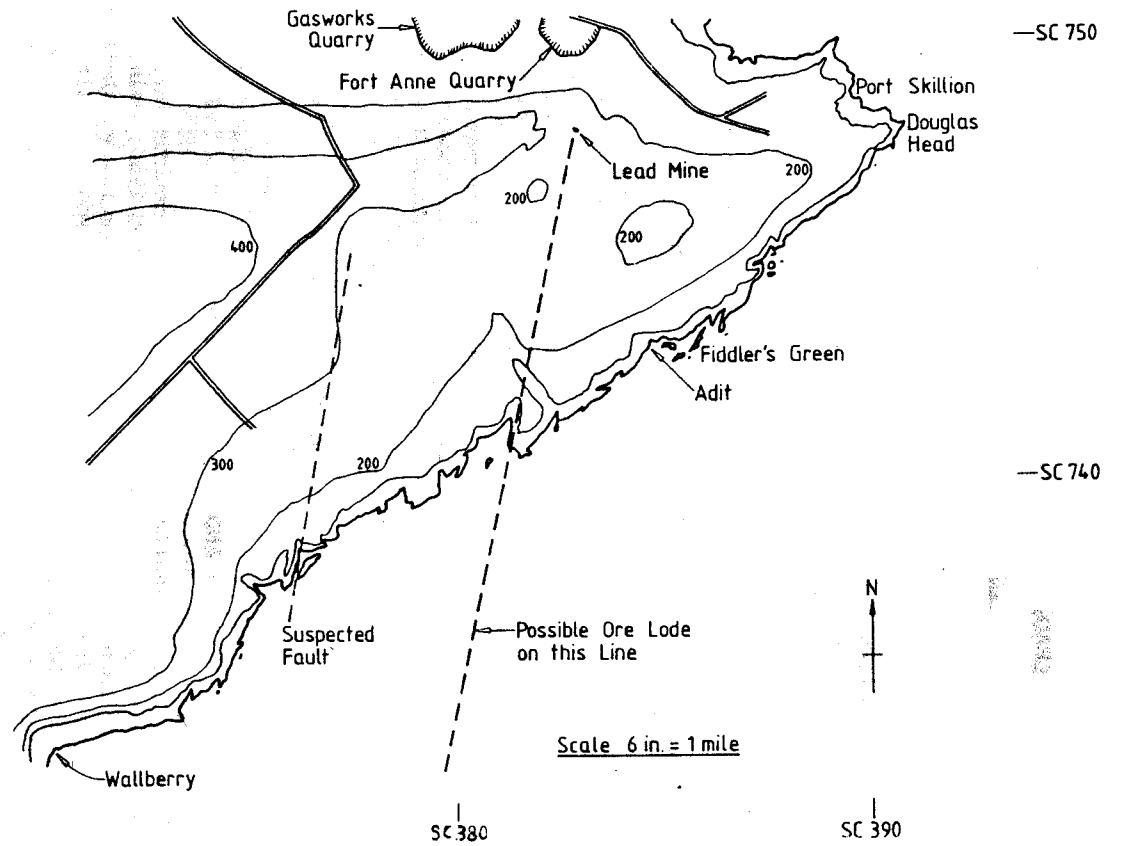


Fig.2. The mines of South Douglas, from the 6" O.S. map (1876).

SSW one passes a ruined cottage with a sump outside it (now used as a drain and soakaway). Below the cottage, an adit, from which water seeps out and eventually runs down onto Douglas Head Road, can be located, but its entrance is blocked. About 180 m above the cottage is the main shaft, almost at the flat top of the headland, about 700 m east of a rocky ridge called the Carnnanes. Continuing in a SSW direction to the coast, one arrives at Stack Indigo lead mine. Another lode is indicated partly by the direction of the contours just east of the summit of Carnnanes and the direction of gulleys and promontories to the SSW on the coast west of Stack Indigo at SC37587380.

Fiddler's Green, east of Stack Indigo at SC385743, contains an adit which is marked on the 1876 six inch geological survey map as an iron mine. Its direction of penetration into the cliffs initially follows that of the other lodes already postulated (SSW-NNE) - see Figure 4 - but later turns in a more easterly direction, almost along the direction of many of the gulleys and cliff-fissures visible at Fiddler's Green in the vicinity of the adit. Finally, at Walberry, the most southerly mine of this group, at SC369733, an iron vein runs approximately NW-SE. The individual sites can now be considered in detail. An adit has been driven from the quarry in the grey slate behind the gas works on Douglas Head Road (SC381751). Here a flow of water into a small artificial pond comes from an adit which heads into the cliff about 20 m, then branches right and left, both sides coming to a dead end after less than 100 m. Grey slate forms the walls and there is now no evidence of a vein. The adit was explored in about 1982-84 by the predecessors of the present Manx Mines Research Group. Nothing of significance was found, and no formal reports were written. It appears from Figure 2, that, to intersect the lodes, the adit would have had to go at least 100 m west and east of its entrance.

The next exposure, marked "Lead Mine" in Figure 2, is at SC382747 on the more easterly lode. Lamplugh (1903) described this as "some utterly profitless work done on Douglas Head between 1865 and 1871, consisting of a long adit driven in from the cliff at the southern side of the headland, and a shaft on the summit SW of Fort Anne Hotel". By 1870, they had found a lode striking NE-SW consisting of umbery gossan at 14 fathoms in the shaft, and the adit, from "Billy Gilbert's Harbour" (SC384743) (Fiddler's Green) had reached 80 fathoms (144 m) in hard ground (the green Lonan flags division of the Manx Slates). The shaft had by then reached 24 fathoms (43 m) without reaching any ore. The adit at "Billy Gilbert's Harbour" was noted by Lamplugh in his list of miscellaneous trials for the 1876 six inch OS. Sheet 13: "Cliff at Fiddler's Green, 700 yards SW of Douglas Head - Adit (see Page 544 - Douglas Head Mine)".

The surface workings at Douglas Head were visited by Hollis (field notes 1975, see Fig.3). A ruined cottage (SC383748) with a capped sump used as a drain is visible from Douglas Head Road. The main shaft lies about 180 m southwest of the cottage on higher ground. There is another adit below the cottage, which is best found by looking for a run of water which has stained Douglas Head Road at one point, and following this up to a damp patch below the entrance of the adit. No-one has recently entered the adit, whose entrance is blocked. The quarry just north and east of this area, and across the road from the site of Fort Anne Hotel, is not the same one as contains the Douglas Gas Works and the adit explored in 1982-4 by the Manx Mines Research Group. However, this more easterly lode should be visible in the adit, but has not so far been observed. The lead mine at Stack Indigo, the southern end of this lode, has not been explored. Little is known about it.

The adit at Fiddler's Green, referred to by Lamplugh, was explored by the Manx Mines Research Group in 1987 (Dobson personal communication, 1988; Parkes 1988). This 1.8m high adit, is easy to walk into, but less easy to reach from the Marine Drive Road. A hand line was let down from just south of the old toll gates on a 75 m high, steep slope to the sea. The adit is about 5 m above high tide level. Their report continues:

"On entry, the adit was found to be dry, apart from the odd shallow puddle (Plate 5). Not far in we noticed some iron spikes protruding from the .....left-hand side of the adit....These supported a lade which carried water away from the end of the adit ... The adit appears to follow a fault in the rock and goes in for approximately 120 metres".

The plan by MMRG of this adit appears in Figure 4. The direction followed by this adit is parallel to the line Stack Indigo to Douglas Head mine.

There is a "lead mine" at Stack Indigo marked in Figure 2, and noted in Lamplugh's list of miscellaneous trials. This is an adit, now obliterated by the repeated landslides and the fill for the Marine Drive road which have filled up the gulley known as "Horse's Leap". Pictures still exist of a lattice girder bridge which took a tramway over it, at a height of over 80 m above sea level. The gulley was about 40 m wide - an awe-inspiring sight, now lost forever. The vein can be studied at and above the level of the road, at the place where the road is closed because of landslips into the gulley. The cliffs tower another 10 - 15 m above the road. Running inland from the gulley is the continuation of the vein, which manifests itself here as quartz with fluccan (clay-like material containing iron oxides), but again with no sulphides. No gossan was seen either. Since

so much is now obliterated, and the land above the cliffs is cultivated, only an estimate of the strike of the vein is possible - approximately NW-SE. The depth of penetration of the adit into the cliff is unknown.

The other possible fault mentioned - that originating on the coast west of Stack Indigo, at SC37587380, is to date conjectural. No evidence for it is known.

The mines so far discussed do not explicitly appear in the compilation by Burt et al. (1983), the mineral statistics themselves, or in the reports of the HM Inspector of Mines, thereby suggesting an early date of working and closure. However, the information is ambiguous - the entries by Burt et al. for "Douglas", from 1845 onwards could be for either Douglas Head or Douglas Bay, or even for the Stack Indigo Mine which Lamplugh (1903) reported as being obliterated by his time (report written about 1897-1900). Burt's figures for 1845 onwards are reproduced here and tentatively assigned (by the present author) to the Stack Indigo Mine on account of their date, the remainder being dealt with under Douglas Bay Mine.

Year	Lead Ore tons	Metal Tons
1846	80	54
1847	160	105
1848	260	170
1849	394	261
1854	no detailed return	

TABLE 2.

	Lead	no detailed return
Production Ownership	1898-1899	John Cain
	1901-1906	John Cain
Comment	1899	Suspended
	1900	Abandoned
	1902	Stopped
	1903-1906	Not worked
Management	1898-1899	Chief Agent Edw. Grose
	1901-1902	Chief Agent, J. Cain
Employment	1898-1899	3 underground 0 surface
	1901-1902	2 underground 0 surface

Table 2 for Douglas Head suggests a small scale reinvestigation or private part-time working of the adit and shaft described by Lamplugh. Had they then realised the possible association between the Onchan and Douglas Head lodes (see later discussion on the geology of these mines) or was their concern to go deeper (by analogy with Foxdale, Laxey and Bishop's Barony) or possibly just to clear remaining ore pillars (as in the final days of Laxey)? Present historical evidence does not tell us.

#### THE ONCHAN (DOUGLAS BAY) MINE

Lamplugh (1903) provided a reference to this mine, which appears in the "Mineral Statistics" for 1891 and the succeeding years (Burt et al. 1983). These mines are shown in Figure 7 and Plate 1. A sump and an adit striking N 30° W go into the slate cliff 200 yards (180 m) west of Derby Castle (now hidden behind the houses on the sea front just below and east of Summerhill Road, SC394775). This corresponds to the western lode of Figure 7. Its direction of strike is approximately NE-SW, parallel to the boundary between the grey slates and green flags - that is along the main hill axis of the island. A report in the *Mona's Herald* newspaper for 1892 states that an almost pure piece of what they called "plumbago" (= graphite, but did they mean galena) was found on the foreshore near Derby Castle and a vein was followed inland from it. The same report stated that the lode contained quartz, baryta, lead, and oxide of iron, though in only small quantities. A later article reported gold, but only a few pennyweights per ton of ore. An exposure of this vein was examined by Hollis (field notes 1966) at a time when demolition had made the Derby Castle site accessible. Figure 5 is derived from sketches made at the time. The present approximate extent of "Summerland" (a leisure complex) is indicated, as well as the lay of the slate cliffs. The area was of grey slate, dipping and striking irregularly, but generally of strike 10° south of west, dip about 70- 80° approximately S-SE.

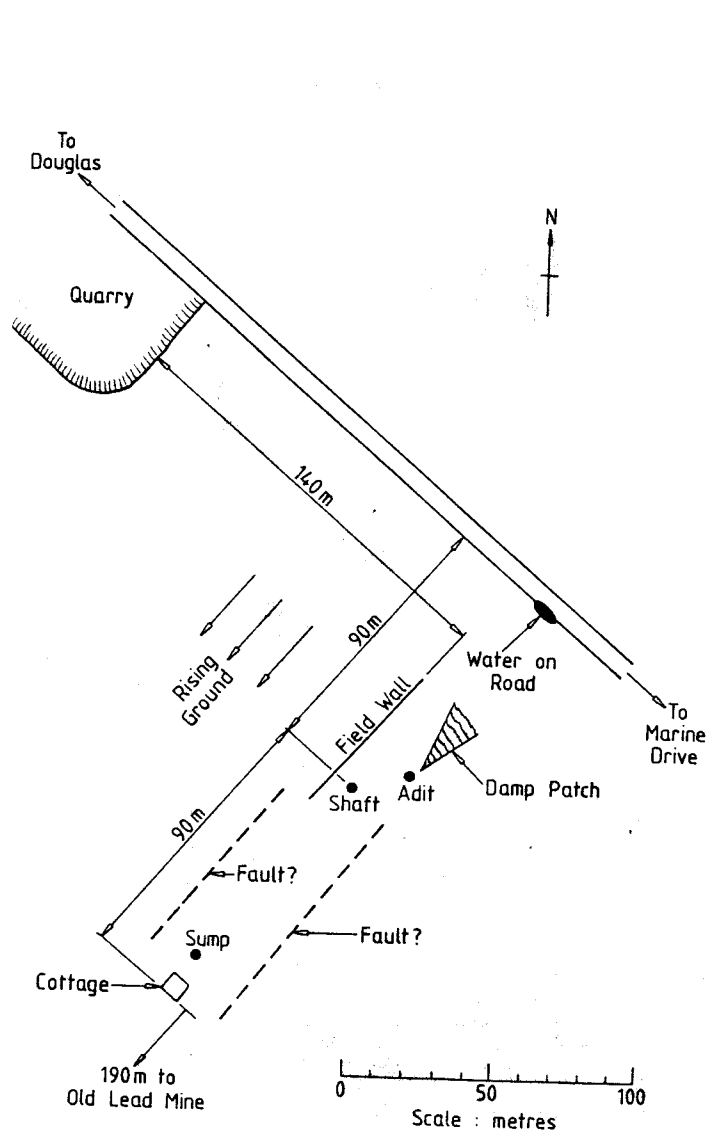


Fig.3. Sketch of the surface workings at Douglas Head from the author's field notes (1975).

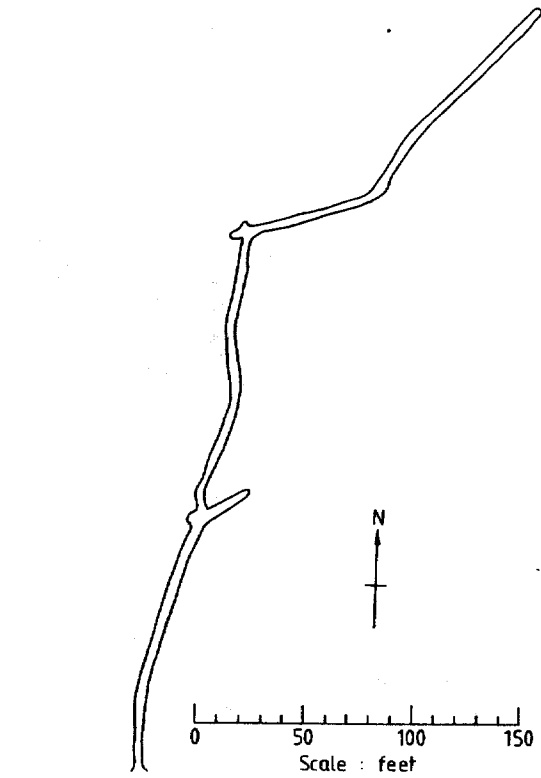


Fig.4. Plan of the Douglas Head adit (at "Fiddler's Green") by the Manx Mines Research Group (1987).

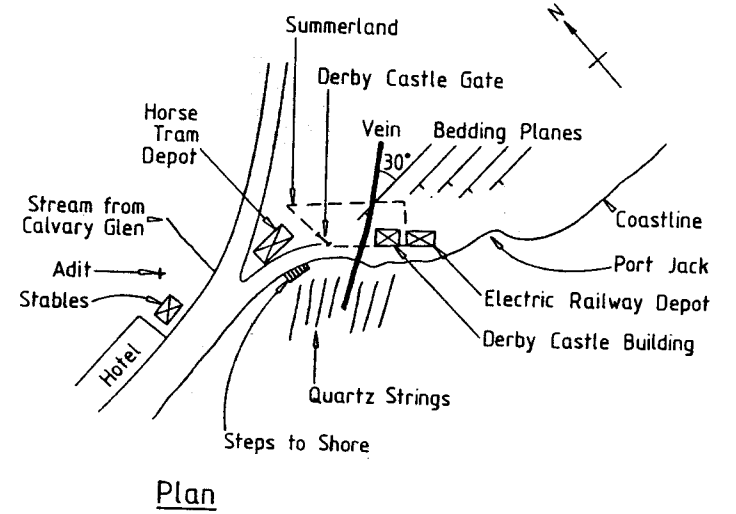
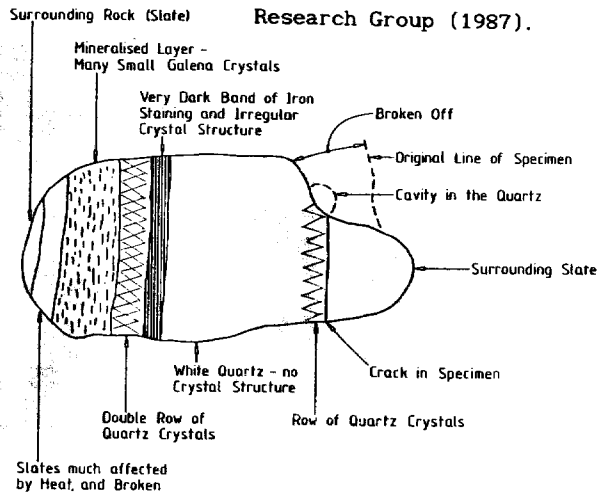


Fig.5. The Derby Castle vein - a sketch plan and elevation from the author's field notes (1966).

The cliffs are about 30 m high. The vein crosses the foreshore and goes under the promenade into the Derby Castle grounds, and into the cliffs in a more northerly direction than that quoted by Lamplugh for the western lode of Onchan Mine. It corresponds to Middle lode of Figure 7.

The vein was of quartz with hydrated ferric oxide. The only larger pieces of lead ore - crystalline galena - came from the shore. No other materials were found. The veins traversed the bedding planes at an angle of about 30° to them as seen on the erosion surface on the shore. That is, their strike was about 10-20° east of north. The dip was not determined. The quartz was glassy, not crystalline. The veins can be seen in Plate 4 as fissures in the rocks of the foreshore.

A piece of quartz was removed from the shore, and broken open. A sketch of it appears in Figure 6. The outer parts - altered slate - were covered in quartz crystals which looked like miniature "Dog tooth" spar. The central portion was white, non-crystalline quartz. In between this central portion, and one of the layers of the crystalline quartz, was a dark band which consisted of hundreds of tiny galena crystals.

The Derby Castle grounds - at the base of the cliffs, near a drainage ditch (part of the adit?) - yielded several pieces of quartz which showed mica, iron staining, and traces of a green substance which was most likely malachite (copper carbonate). These pieces of quartz showed irregular fracture.

Other descriptions of the Douglas Bay mine exist. W.H. Kitto, a director of Foxdale Mine, left a set of papers now preserved in the Manx Museum, Douglas. In these, a plan shows the mines to be in the vicinity of Derby Castle, and that the trials to the east of it are a separate entity.

Williamson (1987) wrote an article whose source material was not specified. Presumably he consulted Kitto's papers, and newspaper reports of that time. The article succinctly describes the history of working, and disposition of the lodes, and is therefore reproduced verbatim here. The map of Douglas Bay mine (Figure 7) is reproduced from that same article. Flookan (fluccan) is crushed rock or clayey material found along a fault zone or vein.

#### DOUGLAS BAY MINE

"This mine was situated on the Northern extremity of Douglas Bay, and extended from a point about 80 fathoms seaward, beyond the low water mark, to a distance which was upward of a mile inland. It contained three highly-mineralised Lodes which ran through the entire length of the Concession.

EASTERN LODE - this was discovered whilst excavating the shingle for the foundation of a new Sea Wall on the foreshore, close to the Manx Electric Railway sheds, and was reported as being a powerful lode, 15 feet wide, with two well-defined walls. It contained ferruginous Quartz, Schist, with a black Oxide and a small amount of Flookan on either wall.

MIDDLE LODE - this could be seen on the foreshore, close to the old Derby Castle entrance, and this lode consisted of Sulphate of Barytes, calcareous Quartz, Oxide of Iron, and a little Flookan. A small pit was sunk on the foreshore in this Lode which produced some rich specimens of Lead and Blende Ores, the former producing upwards of 26 ounces of Silver per ton of Ore, the Blende Ore 48 per cent Metallic Zinc.

At the base of the cliff an Adit was driven on the course of this Lode, which intersected three Quartz reefs, all of which yielded a small amount of Gold.

WESTERN LODE - this Lode was discovered whilst cutting out rock for a terrace of houses on Burnt Mill Hill (Summerhill), and was 2 1/2 feet wide. It consisted of Schist, ferruginous Quartz, Mundic, and small amounts of Flookan (Mundic is iron sulphide - pyrite).

THE ADIT - the entrance to the adit was about 200 feet (60 m) from the sea wall, and was driven on the Lode up to point "C" on the diagram, shown in Figure 7, at which point the Lode then deviated. The Adit cut through three distinct quartz veins, or reefs, at B, D, E on the diagram, all of which, according to assays, were made of the same quality as the samples obtained - Gold yielding as follows:-

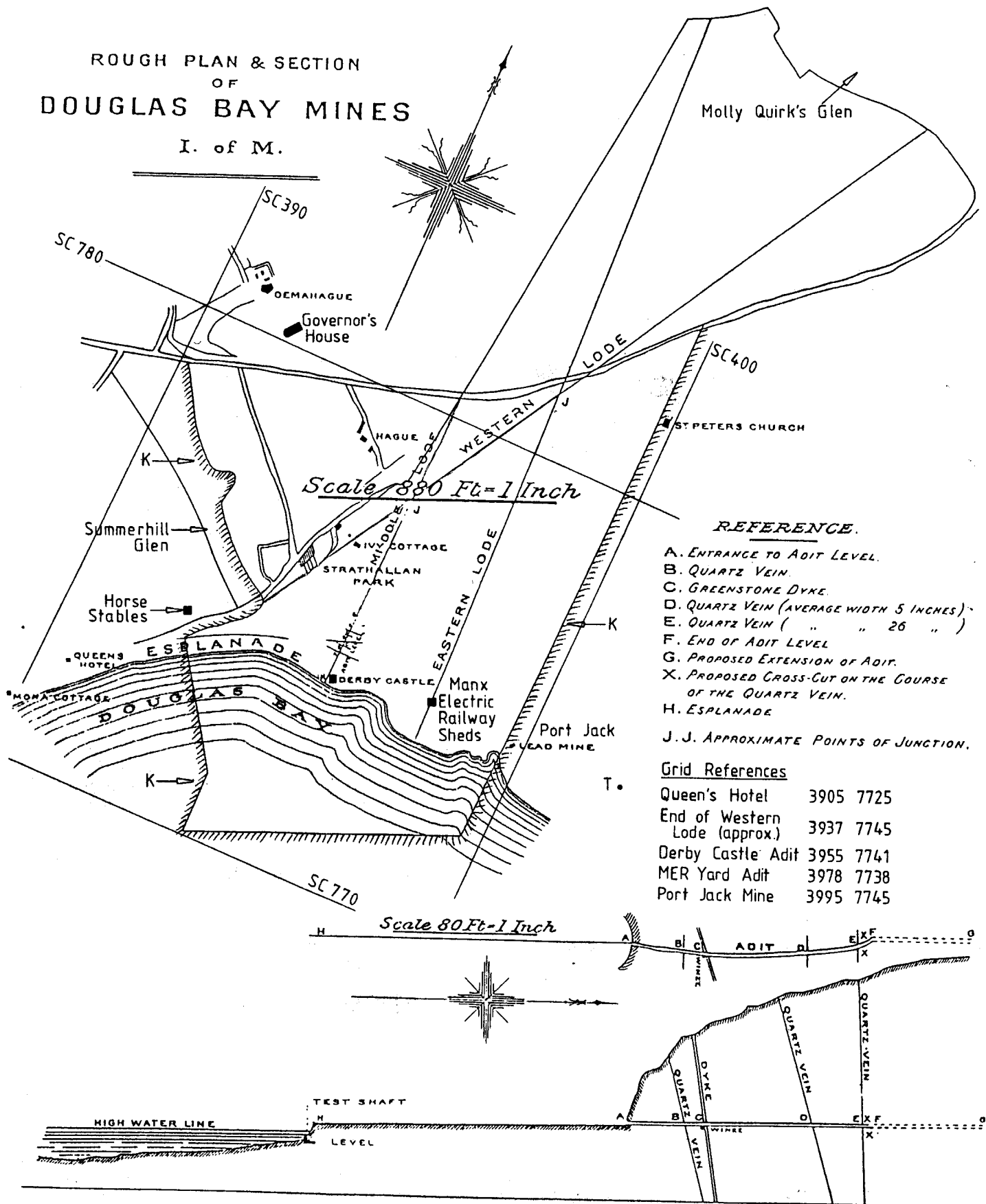
Sample from vein B -----	4 dwts 2 grs of Gold
Sample from vein D -----	10 dwts 5 grs of Gold
Sample from vein E -----	2 dwts 1 gr of Gold

The amount of Gold was per ton of Quartz, and the estimated value of the gold was £3.15s. per ounce. (One dwt per ton is about 9.25 p.p.m. wt/wt.)

If the above figures were put against the price of mining a ton of Quartz it would be found that there was no chance of working at a profit to extract any

ROUGH PLAN & SECTION  
OF  
DOUGLAS BAY MINES

I. of M.



Edmund Spargo, M.E., F.G.S. &c.  
January 1894

Fig.7. Plan in a prospectus for Douglas Bay Silver, lead and blende mines by Capt. E.Grose & Ed. Spargo issued in 1894 (reproduced by Williamson, 1987).

Gold. So, although it was suggested that the company make a further outlay of £1,000 to £1,500, this does not appear to have been done.

Most of the working of this mine seems to have been done in and around 1894. The entrance to the old Adit now lies within the Manx Electric Railway yard at Derby Castle, but is, unfortunately, completely filled in."

A lead mine is marked on Figure 7 at Port Jack. It cannot now be found. Most likely, the building of the coast road and conversion of Port Jack to a small glen for the visitors has obscured it.

East of Port Jack a trial was dug. It is listed in Lamplugh's miscellaneous trials on sheet 14 of the 1876 six inch O.S. map as "600 yards (540 m) east of Port Jack, in the cliffs". No other documentary evidence of it is known, but during the summer of 1956 it was found and entered via a cave by a friend of the author. He reported it as going about as far inland as the Texas Bar (about 100-150m maximum extent). The vein content of it is unknown, but lack of further documentation of it being worked, and the weak development of the associated veins on the cliffs and shore suggests that it was completely barren.

The locations of Douglas Bay mine given by Lamplugh (1903) (200 yards west of Derby Castle), the vein found by Hollis (field notes 1966) at Derby Castle, and the location quoted by Williamson (1987) (in the depot just east of Derby Castle) are all apparently in conflict. However, careful measurement of the Ordnance Survey six inches to 1 mile maps, and exact plotting of coordinates onto Williamson's map (Figure 7) reveals the true situation and several veins can now be related to previous discoveries. Figure 7 reveals locations at

- 1) 394 775 (Western lode) - Lamplugh's adit and sump, Not visited recently.
- 2) 3955 7741 (Middle lode) - Noted by Hollis in 1966, 1967 and 1975.
- 3) 3962 7730 (Eastern lode) - The adit found by Williamson in the railway yard.
- 4) 3976 7736 ("Lead Mine") - Port Jack mine, now obscured by the rebuilt coastroad.
- 5) 4500 7733 ("Trial adit") - Entered in 1956, no recent evidence available.

The vein systems near Onchan head are complex and somewhat different from those noted south of Douglas. They were investigated further by Hollis (field notes 1966). Three sets of faults were seen, both in the (then demolished and levelled) Derby Castle grounds, and on the shore, below the sea wall (Plate 4). The slate strata strike SW-W, dip 60-80° approximately south-east. Faults strike

- 1) almost N, dip 70° east
- 2) almost W, dip 80° south
- 3) almost NW, dip 80° south-east

If the strike of the slates is followed from Derby Castle, then it intersects the sea front again at about SC388770. The first and second systems (ore lodes) are not present. Instead the third fault system dominates, and contains only a few quartz strings.

Over the entire northern end of Douglas Bay the strike of the strata of the rocks is uncertain. In places it is 45° S of W, but mostly it is 10° S of W. Similarly, the second fault system, the quartz bearing one, strikes about due west near Derby Castle, on the shore, but in the headland it strikes about 30° S of W.

At Port Jack (SC399774) the rocks are grey slate, partly schistose. The general strike is SW-W, dip about 60° approximately south-east. Complex faulting at 90° to the dip plane and 60° to the dip plane can be seen. The dip of these is almost vertical in the cliffs. Quartz strings run SW-NE, dip 30°, and NW-SE dip 60°. The former are up to 15 cms wide, the latter being less than 2 cm wide. The important N-S and E-W veins seem to be absent. Vein systems 1 and 2 appear to be weak, and system 3 predominates.

Therefore the veins of interest are strongly localised, and consist of three or more parallel veins running NNE to SSW, in the vicinity of Derby Castle.

System 3 - NW-SE, dip 80°, corresponds to the iron veins discussed in connection with South Douglas. This system appeared barren in the vicinity of the mines on the north side of Douglas Bay.

Burt et al. (1983) gave data concerning the operation of Douglas Bay mine, shown overleaf on Table 3.

The short lifetime of this mine - about ten years, its limited returns, and the small number of employees suggests a small private venture on a set of veins which were poorly mineralised. Since the mines of the Isle of Man tended to become richer in depth, the shallowness of these workings is surprising.

TABLE 3.

Onchan		(Douglas Bay)
Production	Gold	No detailed return
Ownership	1893-1902	Edw. W. Grose (agent at Ballacorkish Mine for many years).
Comments	1893	Named Onchan
	1894-1895	Onchan Suspended
	1896-1898	Named Onchan
	1899-1900	Named Onchan. Work suspended.
	1901-1902	Named Onchan; standing.
Management	1893-1902	Chief Agent Edw. W. Grose Secretary Tho's Kelly
Employment	Year	Underground Surface Total
	1893	2 0 2
	1894-1895	No figures
	1896	8 0 8
	1897	3 0 3
	1898-1902	No figures.

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Onchan		(Onchan)
Production	Gold	No detailed return
Ownership	1891-1892	Chief Agent Edw. W. Grose
Comments	1893-1902	See Douglas Bay.
Management	1891-1892	Chief Agent Edw. W. Grose.
Employment	Year	Underground Surface Total
	1891-1892	2 0 2
	1893-1902	See Douglas Bay.

The trials east of here, noted by Lamplugh (1903), could not have found any worthwhile material, since no mention of them other than his exists - in the list of miscellaneous trials.

#### AN INTERPRETATION OF THE GEOLOGY OF DOUGLAS BAY

The island is dominated by the recumbent NE-SW syncline which forms the double range of hills in the centre of the island (Simpson 1963b). The Cambro-Ordovician slates dip strongly to the southeast. Two divisions exist: those inland are grey and flaky, often split by cracks showing iron staining. Those south-east of a line joining the eastern part of Douglas Head to Onchan Head are green, and hard, and relatively free of iron staining. Two sets of veins appear to predominate in this region. The first strikes approximately either NW-SE or at 90° to that - including the Douglas-Peel Valley and the boundary between the grey slates and the green Lonan flags. This system contains quartz, and hydrated iron oxides, and, as Lamplugh notes, Tertiary intrusions of olivine dolerite, often containing magnetite. From these originate the iron veins mined at such places as Stack Indigo, and Billy Gilbert's Harbour. It would appear from Lamplugh's survey, and from the returns of mines working these veins quoted in Burt's statistics, that these NW-SE running veins are often closely associated with the other major set of veins in this area. This second set will now be considered.

The lead and gold bearing veins generally run about 10-20° E of N in the region south of Douglas Head, and almost due N-S in the region of Onchan Head. No veins of this system have been seen in the intertidal zone of Douglas Bay, but some have been noted on the shore near Onchan Head. The main minerals of these veins have been quartz and iron oxide, with lead and barytes in small quantities, and, rarely, gold. It is significant that south of Douglas (in the adit at Fiddler's Green) a quartz-calcite with iron-manganese assemblage similar to that of the Old Day level at Beckwith's Mine Glen Rushen was noted (Plates 5 and 6). The lead always occurred in more or less N-S running veins, and had a high silver content. This and the evidence from Plates 5 and 6 would suggest an origin contemporary to, and syngenetic to those of Great Laxey and the Foxdale lodes.

The slates at Fiddler's Green (the Douglas Head east coast adit mentioned by Lamplugh) are hard and pale green (the Lonan Flags). By the cottage and the shaft on top of Douglas Head they are grey and more flaky. In the quarries on Douglas Head Road they are less contorted and flaky, but still grey, and with some iron stains. Spoil remains were hard to find at Douglas Head mine. Iron-stained clay slate is present, but no metal sulphides were seen. In this area, the strata dip steeply (80°) WNW-ESE and strike about 20° east of north - roughly in the direction from the Tower of Refuge to Onchan Head on Figure 1. The contents of the veins here are best studied from the pictures taken in late 1987 by

the Manx Mines Research Group (Dobson, personal communication, 1988) in the Douglas Head adit. Plates 5 and 6 show rather beautiful calcite-manganese-iron mineralisation of the kind seen in the upper levels of Beckwith's mine at Foxdale, Isle of Man. It is indicative of possible richer ores at depth, were it not for Lamplugh's report that the shaft did not encounter better ore further down.

By drawing a conjectural lode in Figure 2, and extending it on Figure 1, it is possible to provide a rationale for the ore lodes explored in the area. Stack Indigo, Douglas Head mine and Fort Anne quarry lie on a line which follows the dip and strike of veins observed in the area, and, when extended, has to its west the shore area of Douglas Bay, and to its East, a marked deepening of the sea. At its northern end, it arrives west of certain trials and adits considered here under the section dealing with Douglas Bay (Onchan) mine.

The green Lonan Flags and the grey slates can be traced on both ends of Douglas Bay. The green flags on the east coast side of Douglas Head appear on the east of Onchan Head, in the region of the Howstrake golf course and former holiday camp (SC405775). Further inland, at Port Jack, and Onchan Harbour (Figure 1) comes the band of grey slate which gives most of Onchan and Douglas Head their characteristic colour, and can be traced in Douglas Bay at low tide (Figure 1). It is surmised that the green flags and grey slates are separated by an approximately NE-SW fault line running across Douglas Bay, conjugate to the Douglas-Peel Valley fault (Figure 1). The western lode of Douglas Bay mine also appears to follow a fault belonging to this fault system.

The green flags are harder than the grey slates, and therefore more able to sustain the fissures required for adequate mineralisation. One would therefore expect the best ore lodes to be east of the Douglas Head mine - i.e. in the strata at Fiddler's Green, and also east of the Onchan (Douglas Bay) mine, at or below the Howstrake, where, apparently, no trials were made, and no veins were observed.

A gravity survey (Cornwell 1972) showed the presence of a very weak gravity high east of Onchan. At both Laxey and Foxdale, granites which are of lower density than slate exist near the mines, although they do not seem to have actually provided the minerals (Ineson and Mitchell 1979) and since the vein cuts the granite at Foxdale, it must be younger than the intrusion. The granites which are less dense (s.g. about 2.5) cause gravity lows on the Bouguer anomaly map. The gravity high near Onchan has to be caused by materials of higher density than the slates - greater than about s.g. 2.8. One possibility is that sulphides of density 6.5 to 7.5 exist at depth in the region east of Derby Castle (now Summerland) and Onchan Harbour. However, one would need a very large ore-body of solid sulphides to show up on a gravity survey - hardly likely here. No really deep mines have been made, nor, to the author's knowledge, have any boreholes been driven into the green flagstones of that area, so further comment on the origin of the gravity low is not possible. Its presence in the region of interest is worthy of further investigation.

Several lodes - suspected, not proven - are marked in Figures 1 and 2 in the vicinity of Douglas Head. On Figure 7 at least three lodes are marked, near Douglas Bay (Onchan) Mine. Lamplugh included further suspected lodes in the form of a list of miscellaneous trials of the eastern part of that area. The conclusion is that a series of tension cracks (Carboniferous-Permian?) exists, all of them more or less parallel, at about 30° E of N, on Douglas Head and approximately N-S on Onchan Head. It is believed that they are part of one and the same system.

There are three sets of fissures which do not fit into the above scheme. Billy Gilbert's Harbour (Fiddler's Green) south of Douglas was worked as part of Douglas Head mine. However, parts of the lode there ran approximately NE-SW (Parkes, 1988) (Figure 5). The iron mine at Walberry has already been mentioned. The third item is the third vein seen by Hollis (field notes, 1966) and the western lode in the vicinity of Derby Castle. These all belong to the iron vein system of Tertiary olivine-dolerites (Lamplugh, 1903) conjugate to the Caledonide NE-SW running double range of hills which form the backbone of the Isle of Man.

The later date of the Onchan workings compared to that of the Douglas Head workings would suggest that, although the miners of earlier times had not appreciated any connection between the ore lodes of Douglas, and those of Onchan, the miners of later years may have realised the significance of their findings. The coincidence of Edward William Grose's name (an important figure at Balla Corkish mine in the south of the Isle of Man) in both Douglas Head mine and Onchan mine in the time 1890-1900 supports this idea.

The possibility exists that the best ore lies at depth as found (Lamplugh 1903) in such mines as Balla Corkish, Foxdale, Laxey, and Bishop's Barony. Further, since the ore lodes appear on both extremities of Douglas Bay, and produce minerals characteristic of mesothermal and epithermal conditions (Battey 1972; Park and MacDiarmid 1964), it is a pity that the miners of those times did not consider working deeper, and under the sea from Onchan, and also into Onchan Head. To the author's knowledge, no boreholes have been driven here either. Therefore the true potential of this area must remain unknown.

he was responsible for the plant seen by the French students. He also arranged for several sieves, suspended in water, to be worked by one small waterwheel and Taylor wrote of it that "the effect is excellent, and the expense of the process is so much reduced, that very poor work is returned with profit, that would not have paid upon the old plan". Taylor, J. "Improvements".

12. Raistrick, R. "Ore Dressing in the eighteenth and early nineteenth centuries", Mine and Quarry Engineering, May, 1939. A type of shaking table was installed, by Robert Stagg, at the London Lead Company's Nenthead Mines in 1828. Unlike later tables, however, the concentrate was confined to the table, where it was allowed to form a bed six inches in thickness before being removed. Burt, R. British Ore Preparation Techniques in the eighteenth & nineteenth centuries. De Archaeologische Pers, Netherland, 1982, p. 67. Draws attention to Stagg's table but continues; "Credit for the development of the shaking table is usually given to the German, Ritter von Rittinger, who during that decade (the 1840's) devised a percussion table..". Nevertheless, it is clear that both gentlemen were anticipated by the French development.

13. This diagram is not included but it is very similar to the machine used at Alston. The Low Grinding Mill, at Yarnbury, was built in 1824, when it was equipped with a crushing machine, and, by the summer of 1826, a stamp mill had been incorporated. The Coalgrovebeck, or High Grinding Mill, on Grassington Out Moor, was commenced in Autumn 1825. It too had a crushing machine and, in the autumn of 1830, stamps were added.

14. Phillips, J.A. and Darlington, J. Records of Mining and Metallurgy. London, 1857. p.123. An analysis of 18 crushing mills shows that the size of the crushers used at Grassington had increased and that the rate of crushing was then claimed to be 80 tons per 10 hours.

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Plate XV referred to in the translation above was not bound in with the French volume used, but an almost identical version was found, numbered as Plate VII in another edition and is reproduced here with the captions translated into English.

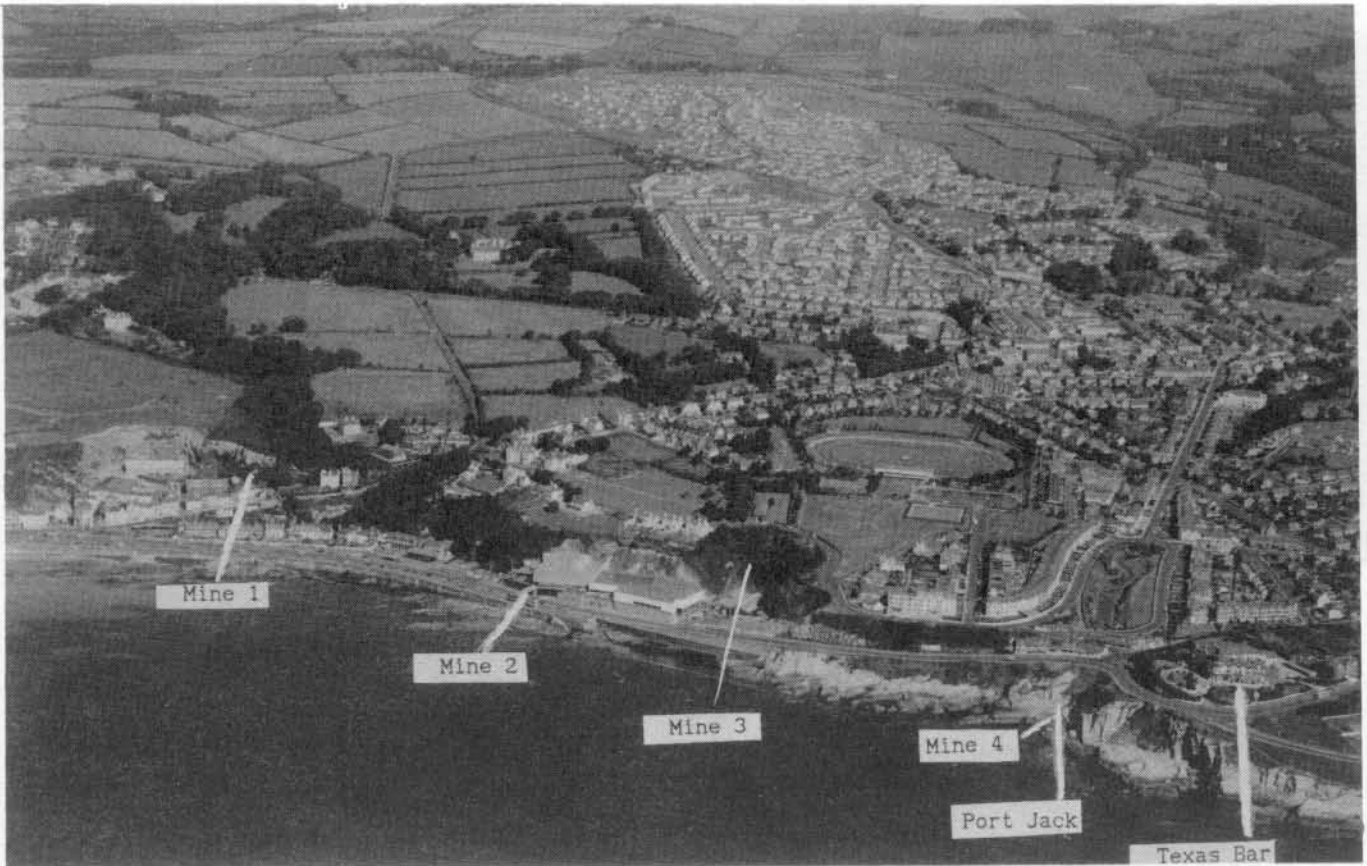
to thank Mr P. Geddes of Laxey Mines Research Group (Douglas) for his helpful comments on this paper, and for information on early investigation both by himself and others.

Plates 5 and 6, and Figure 7 are reproduced by kind permission of the Manx Mines Research Group, Onchan, Isle of Man, and Plates 1 and 2 by kind permission of the copyright owner, Mr. D. Reed, of Manx Technical Publications, Ramsey, Isle of Man.

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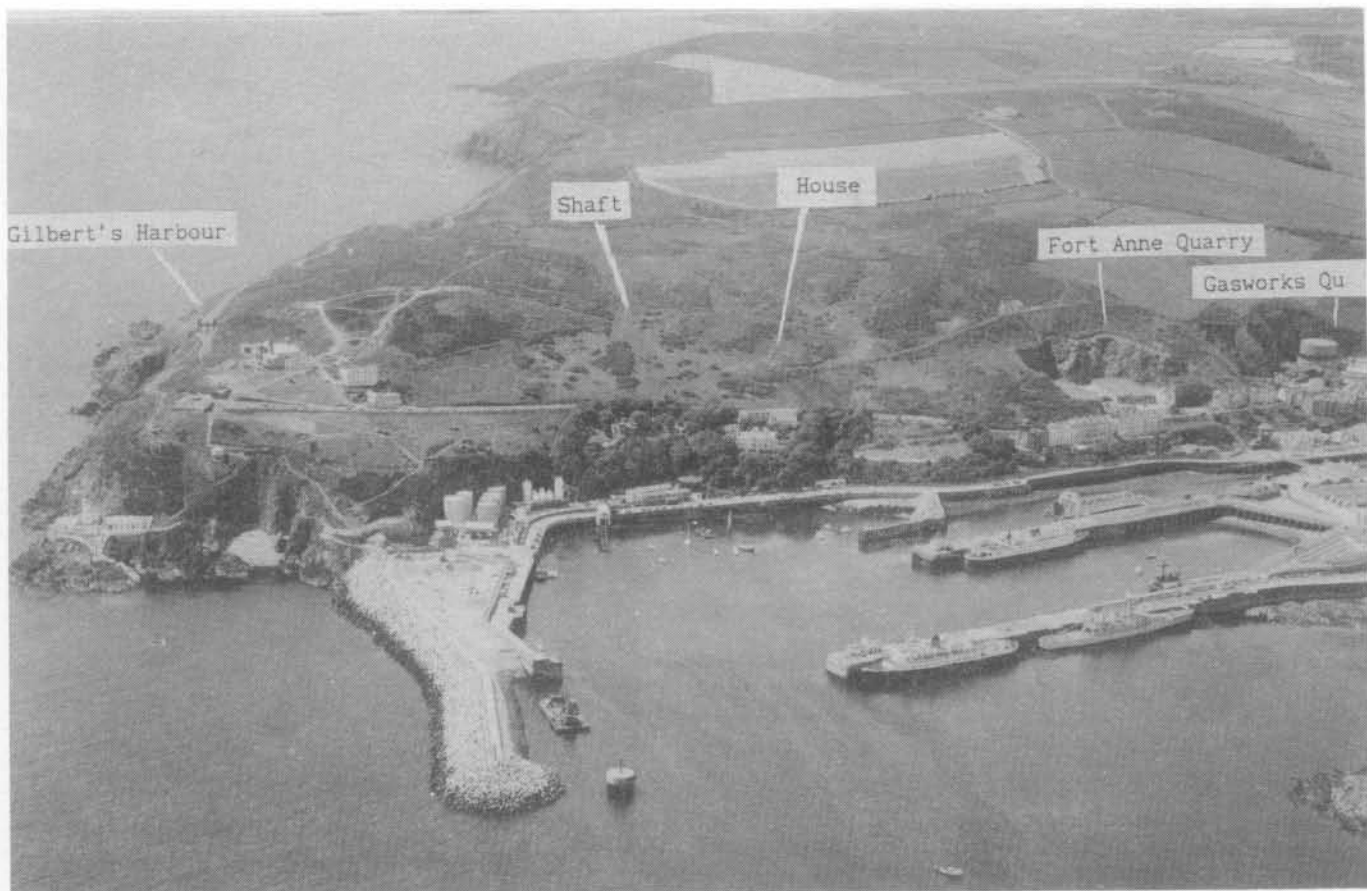
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**CAVEAT:** It should be pointed out that almost all mines and quarries lie on private land. Therefore, BEFORE gaining access, those who wish to go there should OBTAIN OWNER'S PERMISSION. No excavation or structural work should be undertaken until owner's consent is obtained in writing. Beware also of the dangers in old workings, abandoned for many years, with incipient weaknesses in rock walls and roofs, and unstable floors, or in shafts hidden under water. The author of this article does not accept responsibility for those who transgress these simple rules of common sense and good manners.



1. Onchan Head from Douglas Bay.

Mines are arrowed, and named as in the text.



2. Douglas Head from Douglas Bay.

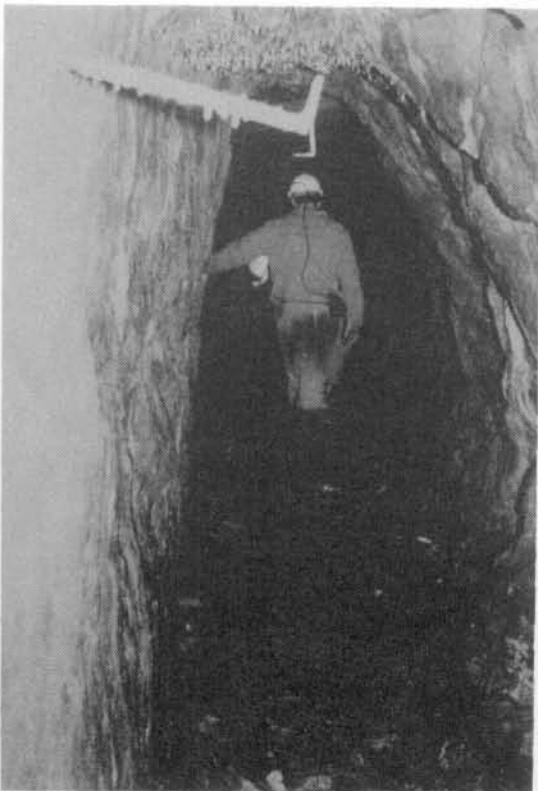
Mines are arrowed, and named as in the text.



3. South-East Side of Douglas Head  
Billy Gilbert's Harbour is arrowed.



4. Shore below Summerland, looking SSW.  
Shows strike of rocks and directions of veins.



5. The adit at Billy Gilbert's Harbour.  
Shows the drainage lade, parts of which are  
on the floor, and the calcite growths on the  
roof and walls.



6. A close-up of the vein in the adit at  
Billy Gilbert's Harbour. Shows the iron-  
manganese-calcite mineralisation.