

EXPLORATION AND SURVEY OF THE GREAT LAXEY MINE, ISLE OF MAN

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ABSTRACT

An outline of the underground workings of the Great Laxey Mine, Isle of Man, is related to modern attempts to re-enter the mine. The Agneash Shaft was descended by members of the 1982 PDMHS Expedition, and a survey made of the accessible parts of the main Adit. This survey is described and compared with previous surveys, with particular reference to A. Jespersen's re-warped version of the original mine plan. Some reasons for the lack of correlation are suggested, but the subject is left for further discussion, and this is opened by some comments from Mr. Jespersen.

INTRODUCTION

A group of PDMHS members visited the Isle of Man in July and August 1982, taking with them a motorised winch to enable them to investigate the underground workings of the Great Laxey Mine. The aim was to clarify doubts about the existing mine survey and descriptions of previous investigations, but the results seem more confusing than ever. Because much of the archive material is held in the Manx Museum in Douglas, it is not readily available to researchers based on the mainland. The authors therefore do not claim the article to be definitive, although they have tried to be as accurate as possible and to indicate where assumptions have been made. They would prefer readers to treat it as a discussion paper that will provoke further research and investigation.

MINE LAYOUT

The Great Laxey Mine was among the largest mines on the Isle of Man, its nearest rival being the complex of mines at Foxdale. However, the majority of the latter have been filled in or obliterated by 'restoration' operations, leaving Laxey as a prime site for the modern-day explorer.

Figure 1 shows a diagrammatic north-south cross-section of the Great Laxey Mine. The backbone of the mine is the Adit, which entered the hillside in the mines yard beside the Laxey River. It followed the line of the N-S trending vein for nearly a mile and a half, rising steadily throughout its length. Ore in wagons was drawn by steam locomotives out of the mine along the Adit, and the Adit also served to drain by gravity all the workings above that level. The majority of the workings, however, were below the Adit and were drained by pumps operated by the 72 ft diameter waterwheel, "Lady Isabella". Water from the pumps was discharged into the Adit, from where it gravitated out to the day.

There were several shafts, the main ones being the Engine Shaft, the Welch Shaft, Dumbell's Shaft and the Agneash Shaft. These were all used for winding, pumping, and ventilation, and were sunk to intersect the Adit. Tradition has it that each shaft was sunk in turn as the Adit progressed northwards, but this is not borne out by the Ordnance Survey map. The 1:2500 O.S. map of 1869, (last reprinted in 1936) shows a shaft at Agneash, whilst Dumbell's Shaft, 110 metres to the south, is not marked. According to Jespersen (1970) Dumbell's Shaft was sunk in 1892 to 1893, whilst Garrad et al (1972) stated that sinking commenced in 1860. George Dumbell was Chairman of the Great Laxey Mining Company at the time of the opening of the "Lady Isabella" in 1854, and Dumbell's Shaft would have been named after him (or one of his successors). In view of its prestige, the shaft would almost certainly have been marked on any revision of the O.S. map, but its absence leads to the conclusion that the O.S. map has not been revised, thus dating the Agneash Shaft as pre-1869, and Dumbell's Shaft as post-1869.

However, the apparent anomaly of the two dates for the sinking of Dumbell's Shaft is explained by a cross-section depicting the mine in 1887, compiled by Mackay and Schnellmann in 1963. This shows the Dumbell's Shaft sunk from Adit to the 266 fathom level, but not reaching the surface. This suggests that the shaft was sunk under the Adit from 1860 onwards, whilst the surface connection was not made until the 1890s.

The water wheel, well, and other buildings shown on the 1869 map near the Dumbell's Shaft site probably served the older Slide Shaft, so named because it was driven at a considerable angle on the line of a fault. The miners would have taken advantage of the weakness of the rock in the fault zone to make for easier drivage, but the long-term instability of the Slide Shaft, and the inconvenience of having no direct connection to the surface, probably led to the decision to sink the surface/Adit section of Dumbell's Shaft. It is likely that when the main shaft was completed, a water turbine on the surface provided power for winding, but it would be interesting to know what type of winder was used underground before this to sink nearly 500 metres of shaft.

Whilst we have no exact dates for the sinking of the Engine and Welch Shafts, the steam-powered beam engine winder serving both shafts was installed in 1846, suggesting that the shafts were well-established by that date.

The old plans also show a "Corner Shaft" near the southern end of the mine, originally sunk in 1862 to exploit a copper deposit, but twenty five years later the machinery had been removed, and the shaft was used as a ladder-way between the Adit and the 30-fathom level.

A further shaft, (the "North Shaft") was started in the later years of the mine's existence and sunk some 60 metres from the surface before being abandoned and filled in 1919. Its site in the fields north of Ballawill Farm is a matter for conjecture.

As well as the main Adit entrance, there was also an "Adit Cross-cut" entrance that provided a direct access into the Adit from the changing house on the river bank, joining the main Adit some 150 metres from the entrance to the latter.

MODERN EXPLORATION

In recent years several attempts have been made to re-enter the mine by the various shafts and Adit entrances.

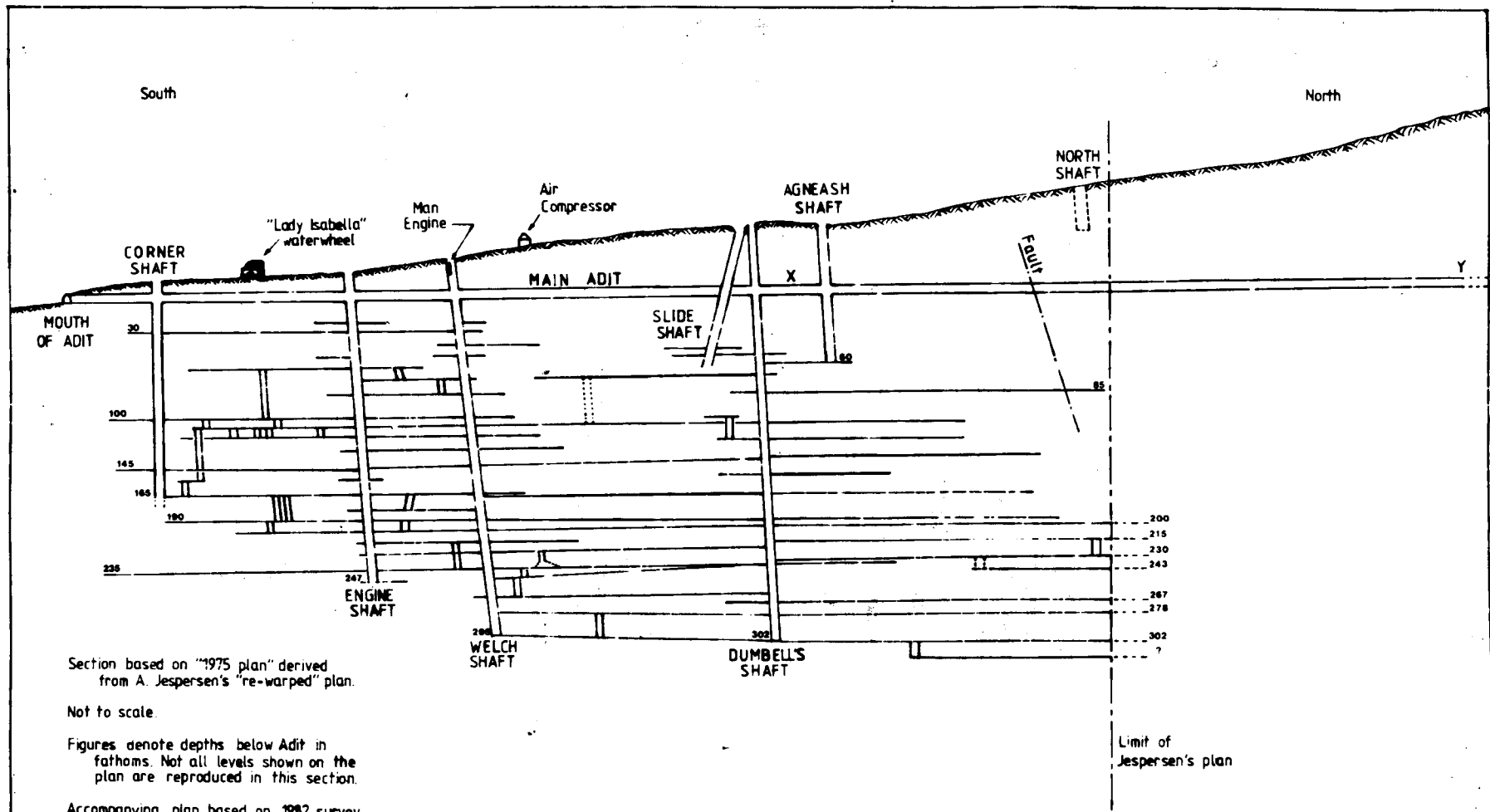
Main Adit Entrance. The Adit has been blocked by collapsing the main entrance, causing water to back up, and this now issues as a small spring. There are no records of any recent attempts to clear the blockage (although this would be quite feasible) but depressions in the fields behind the entrance suggest the existence of further blockages which would make re-entry by this route a fruitless task.

Adit Cross-Cut Entrance. Until recently, the Cross-Cut entrance was marked by a neat walled-up archway in the ruins of the changing house. This wall collapsed about 8 years ago, but revealed little. The stone arched level goes in for about 20 metres before being blocked by a roof-fall, and a corresponding depression can be seen in the fields above.

Corner Shaft. (depth to Adit not known; depth below Adit about 300 m). Little attempt has been made recently to locate the Corner Shaft, the site having been considerably altered by modernisation of Cronk-y-Chule Farm.

Engine Shaft (depth to Adit - 40 m; depth below Adit - 452 m). Access to the Engine Shaft can be gained by electron ladder suspended from the surface rocker-arm of the old pump rods. It is blocked some 30 metres from the surface, and the stone arching above the worked out vein has collapsed, leaving the ground around the shaft head to collapse in turn. The whole area of the shaft head is very unstable and in danger of further deterioration.

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Section based on "1975 plan" derived from A. Jespersen's "re-warped" plan.

Not to scale.

Figures denote depths below Adit in fathoms. Not all levels shown on the plan are reproduced in this section.

Accompanying plan based on 1982 survey shows Adit between points X and Y.

Limit of Jespersen's plan

DIAGRAMMATIC CROSS-SECTION OF GREAT LAXEY MINE

LAXEY, ISLE OF MAN

Fig.1.

Although the pump rods have collapsed, there are sufficient remains of the first and second spears and the fend-off arrangement to confirm the sketches in Jespersen's book. These sketches were drawn by a former miner, Mr. Nelson Kewley, and Jespersen had doubts about their accuracy, as his analysis of the forces in the rod system suggested that the fend-off roller should be to the north. Examination of the shaft by PDMHS and the Manx Mines Research Group (MMRG) in 1982 showed Mr. Kewley to be accurate in every detail, with the roller pointing to the south.

Welch Shaft. (depth to Adit - 55 m; depth below Adit - 540 m). The Welch Shaft houses the Man Engine some 15 metres below the shaft top, and this has been described in a previous Bulletin (Gillings, 1975). A descent to the Adit by PDMHS members in 1982 confirmed the findings of the MMRG descents in 1970 and again more recently. Briefly, much of the shaft is actually part of the stopes, rather than an enclosed shaft, hading at about 10° to 15° to the vertical. The shaft below the Adit is blocked, and roof collapses north and south limit the accessible length to about 300 metres.

A pile of collapsed material in an enlarged chamber marks the probable site of the Engine Shaft where it intersects the Adit.

One notable artefact is the rocker arm and balance box for the Man Engine rods. It is constructed in the conventional timber form of an inverted 'T' with iron braces; the beam is some 15m long, the upright arm being 7m high. The balance box is about 3 m square and 2 m high.

Dumbell's Shaft (depth to Adit - 110 m; depth below Adit - 553 m). This shaft is blocked some 50 m from the surface, (i.e. well above the Adit level) and an attempted SRT descent by members of MMRG in early 1982 was hampered by lack of sufficient rope. Access for a motorised winch is very awkward and the large shaft mouth (4.5 m square) and high surrounding wall precludes setting up any conventional temporary headgear. Clearly, there is scope for further investigation.

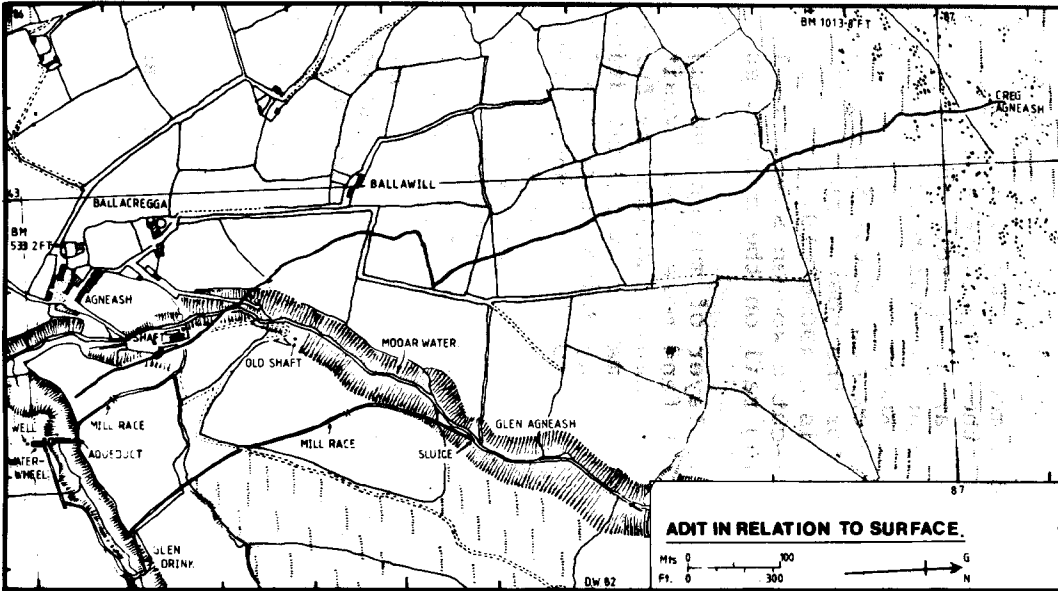
Agneash Shaft (depth to Adit - 109 m; depth below Adit - 120 m). The Agneash Shaft is in a private garden, surrounded on all four sides by a stone wall between two and three metres high, topped with broken glass. Access is gained through a small Adit from the riverbank which enters the shaft 3 m below ground level.

The shaft was descended in 1971 by an expedition from the Derbyshire Caving Club and members of the Manx Mines Research Group and access was obtained to the Adit level. The estimated length explored was 1050 m northwards and 140 m southwards, (i.e. some 30 m beyond Dumbell's Shaft, which was clearly identifiable where it intersected the Adit). The team found several wagons and kibbles in the vicinity of Dumbell's Shaft, and the MMRG subsequently brought three wagons and one kibble to the surface via the Agneash Shaft.

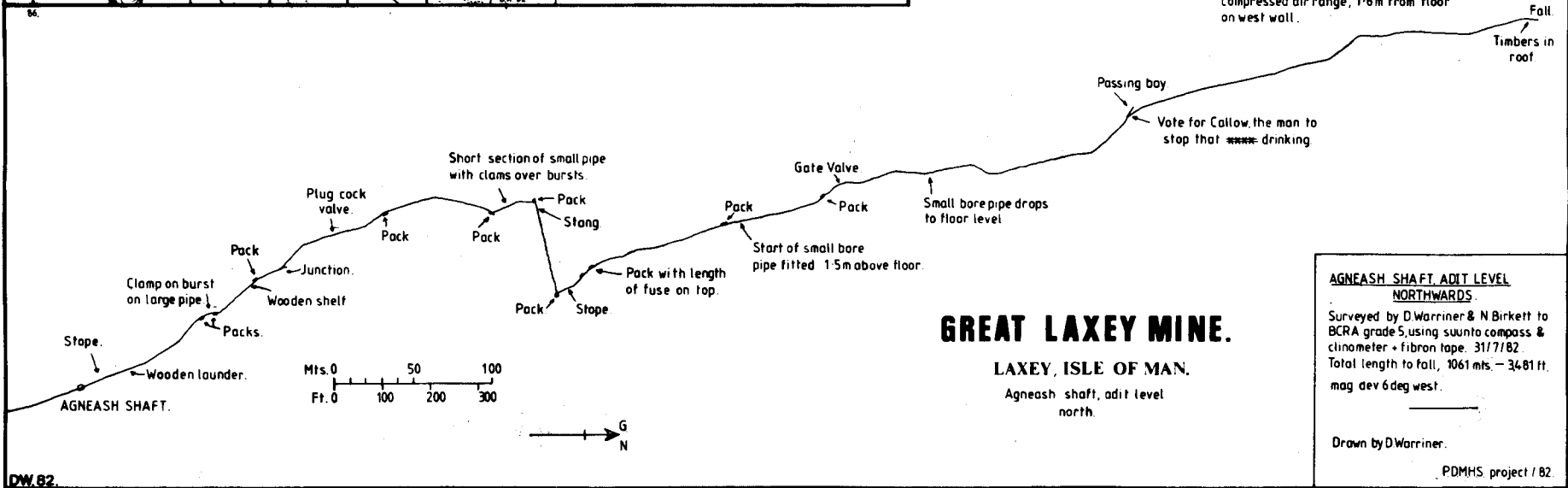
The Agneash Shaft is blocked, mainly by domestic rubbish, at the Adit level, and whilst Dumbell's Shaft is clear at the Adit, it is blocked by debris only a few feet further down.

Another descent of Agneash Shaft was made by mainland explorers in 1974, again with assistance and guidance from MMRG. A further descent made in 1982 when a party from PDMHS visited the Island. One of the objects of this visit was to make a survey of the Adit for several reasons. Firstly, the 1971 expedition recorded that the north Adit terminated in a 'rock face' and the compressed air pipe that runs throughout this part of the Adit was fitted with a cap end. In 1974, the passage was found to be blocked by a roof fall, and the air pipe was buried in the fall. Secondly, the 1971 visit estimated the north Adit to be 1050 m long, whilst the survey published by Jespersen (1970) stopped short at about 600 m. This plan was based on the original mine plan and Jespersen had had difficulty in aligning this original plan with surface features. He came to the conclusion that the mine surveyors had taken insufficient notice of the change in magnetic variation over the years, resulting in a warped plan. He therefore 're-warped' the plan using computer techniques and produced a much better correlation between the plan and the surface features.

Fig.2.



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DW.82.

The PDMHS group therefore hoped that a survey would determine the true present length of the Adit, and possibly estimate how far the passage extended beyond the fall. By comparing the new survey with Jespersen's 're-warped' plan, it would be possible to check whether his magnetic variation theory was correct.

THE 1982 SURVEY

The new survey carried out in 1982 by Messrs Warriner and Birkett is shown in Fig. 2 and covers the Adit level from a point mid-way between Dumbell's and Agneash Shafts, past Agneash Shaft, and northwards to the point where progress is stopped by a fall (Fig. 2). The total distance measured along the passage was 1061 m, with the Adit maintaining an almost constant size of 1.9 m high and 1.1 m wide. The gradient is about 1° to $1\frac{1}{2}^{\circ}$, or 1 in 50, considerably steeper than the 1 in 192 that Jespersen assumed.

Leaving Agneash Shaft and going northwards, a small wooden launder, 210 mm wide and 170 mm deep, is seen on the west wall, extending from the shaft for 30 m to a small stope above the level. In the roof at this point there are corrugated iron sheets on timbers guiding water from small feeders into the launder.

Running along the west wall for the entire length of this part of the Adit is a 75 mm diameter galvanised steel air pipe. Along its length there are two valves, one a gate valve and the other a plug valve. The water-powered air compressor was situated in the valley bottom about 400 m south of Dumbell's Shaft, and there is evidence of the pipe in Dumbell's Shaft where the air was brought underground to drive drilling machines.

Not far from a junction leading off to the right into a back-filled passage there is a wooden shelf about one metre long on the east wall. This may have been used to hold a lamp to warn of the junction ahead. On the junction there was a timber rail switch in use.

About 330 m north of Agneash Shaft the Adit meets a major fault, and a cross-cut was driven east and west to re-locate the vein. The miners found this 59 m to the east, and after working a small area to prove the ore, back-filled the western leg of the cross-cut and also an extension to the east. How far these back-filled passages extend is not known.

Just north of the cross-cut the trial stope extends above the Adit for about 10 m, with numerous wooden stemples, but for the most part the Adit is driven in the solid. Throughout the Adit there is a 490mm (19 $\frac{1}{4}$ inch) gauge rail track, and at the western end of the cross-cut a wooden stang for lifting tubs back onto the track, and a well-worn rubbing rail on the corner, suggesting that derailments were a frequent occurrence.

On the north wall of the cross-cut the thin layer of mud on the slickensided rock has provided an ideal medium in which miners (and more recent visitors) have written their names and other messages. At a small passing bay further north there is an inscription 'Vote for Callow, the man to stop that drinking', a reference to the argument many years ago over Sunday drinking on the Island.

Throughout the Adit there are a number of packs on both sides of the level, one of which still has a length of slow-fuse on top. As the level continues northwards a 37 mm pipe has been fitted on the east wall, and this continues to the fall at the end of the level. The larger pipe also goes into the fall and, had time allowed, a way on could almost certainly have been made through the fall, as the evidence is that the Adit continues further.

At the time of the visit it was only possible to go underground once, and so the survey had to be carried out in four hours. Surveying was not helped by having to contend with the problem of magnetism from the rails and compressed air pipe affecting the compass.

COMPARISON OF SURVEYS

For ease of reference, the following terminology will be used:

"The Mining Plan" - the original plan, now lodged in the Manx Museum, and probably representing the abandonment plan of the Mine;

- "Jespersen's Plan" - the re-warped plan produced by Jespersen, and published at a reduced scale in his book on the Lady Isabella Waterwheel;
- "The 1975 Plan" - a tracing made from Jespersen's print-outs at the same scale as the original mining plan; and reproduced here on a reduced scale, as Fig. 3.
- "The 1982 survey" - the recent survey carried out by Warriner and Birkett.

The 1982 survey shows a total length from Agneash Shaft to the fall of 1061 m - slightly more than the 1971 expedition estimated! However, the 1971 estimate was based on counting paces and taking them to be 24 inches long. If in fact they were nearer 30 inches, the passage could be around 1300 m long, so we may reasonably conclude that the terminal roof fall occurred between 1971 and 1974 and the passage continues for possibly a further 250 m. Jespersen's plan terminates at the edge of the 1:2,500 Ordnance Survey Sheet no. VIII 14, (approximately the 866N gridline) but since he was mainly illustrating the surface water-collecting system for the Lady Isabella, this cut-off point is probably of no significance to the underground plan. The 1975 plan was derived from the same source, and thus terminates at the same point.

Settling the validity or otherwise of the magnetic warping theory was not so straightforward: the original mining plan is drawn up on linen cloth, 5.3 m long and 0.9 m wide, drawn to a scale of about $1\frac{1}{4}$ inches to 10 fathoms, or 1:576. Jespersen took a copy of this, and adjusted it for the changing magnetic variation throughout the history of the mine, producing a series of computer print-out sheets each covering an area of about 200 m square. These were then reduced to 1:2500 scale, superimposed on the 1:2500 O.S. sheet, and the composite plan reduced to 1:5000 for publication.

Gillings obtained copies of the computer print-out sheets, aligned each sheet as nearly as possible with its neighbour, and produced a master tracing on a single sheet. This copy forms a useful working plan, but being 3.2 m long by 0.75 m wide it is only reproduced here in reduced format. (Fig.3).

A comparison between the 1975 plan and the 1982 survey shows the 1975 plan at Adit level to be substantially correct. The general line of the Adit from Agneash Shaft northwards runs on the correct bearing, but the bearings of the long cross-cut differ by 3° between the two plans, and the distance from Agneash Shaft bottom to the cross-cut is 11.6 m shorter in the 1982 survey.

The reasons for these errors are open to speculation, but the following factors have been considered:

- i) The 1982 survey is probably accurate to within 1° and 0.05 m;
- ii) The 1975 plan is the result of the Mining Plan being copied, transferred to computer input, modified, output, printed, traced and reprinted. Each copying stage can result in errors and dye-line printing tends to stretch drawings in one direction only.

Clearly the next stage must be to compare the 1982 survey directly with the original Mining Plan.

Problems were also encountered in plotting the 1982 survey onto the 1:2500 surface map: Agneash Shaft is inclined at about 9.8° to the vertical, offsetting the shaft/Adit intersection 18.5 m eastwards from its surface location. This assumes the shaft depth to be 109 m, based on Jespersen's interpretation of the Mining Plan and the O.S. levels, from which he estimated the Adit gradient to be 1 in 192. If, as the 1982 survey suggests, the gradient is 1 in 50 throughout the entire Adit, the shaft would be only 91 m deep, reducing the offset to 15.5 m. Clearly, a good surface survey, to establish the level of the shaft head, and a shaft survey to determine the depth and hade, are essential if any sense is to be made of the underground survey.

The lack of printed grid lines on the 1:2500 sheet necessitated transferring these from the 6 inches:1 mile (1:10560) sheet using field boundaries and significant buildings to correlate the two. An examination of Jespersen's plan shows that his grid lines do not align with those on the O.S. map, and as he used these as a reference in the re-warping exercise, we have another possible source of error.

CONCLUDING REMARKS

Far from settling any doubts as to the accuracy of the original mining plan, the 1982 survey has produced more contentious points. Clearly, a shaft survey would serve to fix the Adit/shaft intersection relative to the surface, and a check measurement along the Adit would confirm the accuracy of the 1982 survey. Observations with a theodolite could also confirm whether the rails and pipes in the Adit had affected the compass. Unfortunately, organising a return visit to Laxey is not as easy as it would be to a mainland site, as it involves an expensive four-hour sea crossing, and negotiations for access have to be carried out at a distance or through intermediate parties, but hopefully something can be arranged for the future.

Readers of this article might assume that the authors have set out to criticise Anders Jespersen's book describing the Lady Isabella Waterwheel by pointing out his inaccuracies. Nothing could be further from the truth.

We found ourselves hampered by inadequate information, with little opportunity to travel to the Island to consult documentary evidence to confirm our findings, yet we had the advantage of several years of collected experience on the Island.

Mr. Jespersen, on the other hand, visited the Island on just two occasions over thirty years ago, when industrial archaeology was hardly considered a proper subject for study, and then wrote his 94-page book whilst working in Scotland and his native Denmark. Faced with such a formidable task, it is a tribute to him that he produced such a comprehensive work, and thereby introduced the mysteries of mining and water-power to a much wider audience.

ACKNOWLEDGEMENTS

We are extremely grateful to Mr. Dave Luton, the owner of Agneash Shaft, for permission to use his garden to set up our winch and to descend the shaft. Thanks are also due to members of the Manx Mines Research Group for making the preliminary arrangements for access, to P. Challis for the supply of survey instruments, to N. Birkett for assistance with the surveying, and to J. Grayson and J. Stapleton for help in drawing up the 1982 survey. We are indebted to Anders Jespersen for providing a copy of his re-warped plan, and for his comments on our article which are produced below in Appendix 1.

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Andy Gillings sent a draft copy of this article to Anders Jespersen, who was kind enough to telephone from Denmark with the following comments:

When Jespersen 're-warped' the Plan in 1954, electronic computers were in their infancy and not available for a project such as his. Instead, he had to 'compute' (hence the misunderstanding!) the necessary corrections manually. He drew the 243.2 km Easting grid line on to the original plan as a warped line and added parallel and perpendicular lines (also warped) to form a distorted grid pattern of 100 m x 100 m 'squares'. The contents of each square was then retraced, square by square, onto a true grid to produce the plan from which Fig. 3 has been subsequently copied. Jespersen confirmed that the limit of his re-warping exercise was the northern edge of the 1:2500 O.S. sheet: the original mine plan extends further north.

To plot the grid lines onto the 1:2500 sheet, and thence onto the mine plan, Jespersen obtained from the Ordnance Survey office the co-ordinates (to the nearest 100 mm) of each corner of the sheet, and then divided the sheet into 100 m squares accordingly. Since they fitted perfectly, he has no reason to doubt the accuracy of the corner co-ordinates, and feels that the 6 inches:1 mile sheet used by the authors to transfer the grid lines to the 1:2500 sheet was not sufficiently accurate. He encountered similar problems in Scotland where the 6 inches:1 mile and 1:2500 grid lines could not be made to coincide.

Jespersen originally calculated the gradient of the Adit to be 1 in 192.5 based on levellings of the Adit Entrance and the Adit Cross-Cut Entrance. He considered that the slope must be (a) sufficiently steep to ensure that water would flow out, but (b) not too steep for locomotive haulage. He adopted the figure of 1 in 192 as it seemed to be a 'nice "British" figure' of 1 foot in 32 fathoms. (Remember that, as a Dane, Jespersen normally works in metric units).

However, he was not entirely happy with the levellings, as they had been made on his behalf, not from an established bench mark, but from a spot height on the Laxey - Agneash road. He would like to see a surface survey based on an accurately known bench mark levelling, and this, together with a shaft survey at Agneash, would give a much better measure of the Adit gradient, averaged over a far greater length, and also an accurate fix of the Agneash Shaft/Adit intersection in relation to the surface plan.

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