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DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1963/111

THE OLD BRADLAUGH MINE, HERBERTON TINFIELD, QUEENSLAND.

by

B.J.Amos

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RECORD NO. 1963/111

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THE OLD BRADLAUGH MINE, HERBERTON TINFIELD, QUEENSLAND

INTRODUCTION

A surface and underground geological survey of the Old Bradlaugh Mine (United Bradlaugh Mines) was carried out by a party of geologists from the Bureau of Mineral Resources, between the 27th September and 8th October, 1962. The survey formed part of a regional mapping programme of areas of north Queensland.

The Old Bradlaugh Mine is one of the most easterly tin mines in the main section of the Herberton mining area which covers about a square mile of hilly country east of and immediately adjacent to the town of Herberton, north Queensland.

The surface of the mine was surveyed by plane table and telescopic alidade and the results plotted at a scale of 40 feet to one inch; accessible underground workings were surveyed by tape and compass, and plotted at a scale of 20 feet to the inch. Geological mapping was carried out and the information plotted on the base plans and sections, copies of which accompany this report. They are numbered as follows:

Plate 1	Surface (contoured)	40 feet = 1 inch
2	Adit level (No.1 level)	" "
	including insets:	
	2a (No.1a sub-level)	" "
	2b (No.1b sub-level)	" "
3	100 ft. level (No.2 level)	" "
	including insets:	
	3a (No.2a sub-level)	" "
	3b (No.2b sub-level)	" "
4	200 ft. level (No.3 level)	" "
	includes inset:	
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PREVIOUS WORK

R.L. Jack published a report on the Herberton mining area in 1880 and another in 1883. Other reports that followed were concerned with individual mines such as the Black King (L.C. Ball, 1923), Good Friday (L.C. Ball, 1923), St. Patrick (L.C. Ball, 1923), and Great Northern Gully Shaft (J.H. Reid, 1933). In 1939 a general report on the district was produced by AGGSNA (Jensen, 1939) and in 1951 E. Broadhurst published a paper in which he summarised the structure of all the mines in the area, including the Old Bradlaugh, as far as possible, and attempted a structural synthesis of the area.

PRODUCTION AND PRESENT ACTIVITY

Production of tin oxide from the Old Bradlaugh Mines has totalled almost 1500 tons. Current production (1962-3) is being won mainly from ore broken in stopes and exploratory driving from the south end of the No.4 level and is at the rate of 100 tons per annum. Exploration of the Leviathan Lode, above the No.1 level, is in progress.

GENERAL DESCRIPTION OF THE MINE

The present entrance to the mine is by an adit which connects with the vertical main shaft at the haulage chamber. The main shaft extends upwards from here to the surface but has been blocked off above the adit or No.1 level. There are three main levels below the adit level: No.2 level (100'), No.3 level (200') and No.4 level (270'), all accessible from the main shaft.

There are six sub-levels below the adit level: sub-levels 1a and 1b (52 feet and 65 feet) between No.1 and 2 levels, sub-levels 2a and 2b (122 feet and 156 feet) between No.2 and 3 levels, sub-level 3a between No.3 and 4 levels, and sub-level 4a below No.4 level. These sub-levels are accessible from the main shaft except No.3a and 4a which are only accessible from No.4 level. A series of connecting sub-levels below the adit level on the Leviathan Lode also do not connect to the main shaft.

Two main lodes were worked in the mine, the Bradlaugh Lode which lies to the north and west of the main shaft, and the Leviathan Lode which lies to the south of the main shaft. The stopes on these lodes are now inaccessible in places. The Bradlaugh Lode has been stoped out from the surface down to sub-level 3a, where it appears to cut out. All the main levels connect with this stoped out area, and so do sub-levels 1b, 2a, and 2b. The Leviathan Lode has been stoped out from the surface to the adit level, and this stope is now filled with mullock. The lode continues below the adit level for about 100 feet through a series of sub-levels and connecting shafts, and these workings can be reached from the adit level. The lode has not been worked between this and No.3 level, where an inclined shaft has been sunk on a lode down to No.4 level and a short rise and sub-level have been put in above No.3 level (nor surveyed). A short winze from No.4 level connects with sub-level 4a which was under water at the time of the survey.

GEOLOGY

General

The mine is situated entirely within Elizabeth Creek Granite. The granite is strongly jointed and faulted, and along some of these joints and faults the granite has been altered to a very hard dark rock in which the white quartz phenocrysts contrast markedly with the almost black colour of the rest of the rock. This rock is known locally as "black rock" and constitutes the major lode material. Cassiterite occurs in the lodes with or without associated crystalline quartz. Where observed, the tin is in every case associated with "black rock"; though not every occurrence of "black rock" is stanniferous. As the occurrence of "black rock" is commonly controlled by a joint or fissure in the granite, the bodies of "black rock" are mostly roughly tabular in form and range from a few inches to 20 or 30 feet in width. Some seem to be irregular, and may result from the intersection of two or more fissures.

In places the body of "black rock" has irregular veins and patches of white vein quartz within it, commonly near the centre. Fluorite is not common in this mine, but has been found on No.4 level.

The granite shows no variation in composition or texture other than the development of "black rock". The dykes of porphyry and aplite described from other mines in the area do not occur here, nor do lodes corresponding to the "chlorite lodes" of some of the other mines.

Joints and faults

The dominant fracture planes in the mine are vertical, north-striking joints or faults (referred to as heads in the plans). Other less prominent joints strike north-west and north-east with steep dips, and there are some less steeply dipping joints or faults whose angle of dip ranges from about 15° upwards, and whose direction of dip ranges from south through east to north. A stereographic plot of the poles to all the joints and faults measured in the mine shows the north-striking fractures as a very strong maximum, with the north-west and north-east striking joints as subsidiary maxima on either side (Fig.1). There is also a poorly defined girdle of poles about an axis that plunges north-east; this girdle includes most of the gently dipping joints.

Some of the north-striking fractures are very prominent features, persisting for many hundreds of feet laterally and vertically. In most of the other mines in the field joints or faults of this set are the fractures that control the lodes, and are known locally as "indicators"; this term will be retained in this report for convenience in descriptions.

The majority of the joints in the mine show no indication of movement, but a few of them are slickensided and striated in varying degrees. Most of the striae have a low angle of plunge, in most cases less than 15°. All the slickenside striae measured in the mine have been plotted on Fig.2, and it can be seen that the striae on the indicators all plunge at low angles north, and this agrees with measurements of striae on the indicators in other mines recorded by Broadhurst (1951). No striae were observed on the low angle joints.

The Bradlaugh Lode

The Bradlaugh Lode is the main lode of the mine. It was originally mined at the surface by opencut; a shaft was then sunk in the opencut, and the ore below stoped out. Part of the stoped area can be entered at the adit level. Here the lode lies along a zone of strongly developed north-striking joints which are nearly vertical (the Indicator). Above the adit level the stoped area makes a step of about 10 feet eastward before continuing to the surface (Section B). Below the adit level the Indicator continues down to No.2 level without interruption.

Superposition of Plans 2 and 5 indicates that the ore shoot has an overall pitch to the south of about 65°, which brings the ore shoot much closer to the main shaft at the lower level. Individual sections of the shoot pitch very steeply south, and the flatter overall pitch reflects the disjointed nature of the body and is caused by offsetting along joint planes. The dip is steep (about 80°) to the west but, again, offsetting on joint planes makes the overall dip considerably flatter.

Below No.2 level the Indicator continues vertically downwards as far as sub-level 2b. Between sub-level 2b and No.3 level the Indicator is displaced 25 feet westward, and the continuation of the ore shoot downwards is displaced to the north. The point where the Indicator is displaced in this fashion is not at present accessible, but Broadhurst (1951) shows it as being caused by a low-angle fracture dipping north at about 30°.

On No.3 level the Indicator is 40 feet west of the shaft and the main drive follows it for 230 feet. The ore shoot is at the northern end of the drive and the rest of the Indicator exposed in the drive is barren (Plan 8).

Below No.3 level the Indicator continues vertically downwards to 3a sub-level, where it ends abruptly against a flat fault dipping approximately 30° to the east. No continuation of the Indicator beneath the flat fault has yet been found. The ore shoot between No.3 level and 3a sub-level has plunged southward slightly.

On No.4 level the numerous branching passages west and north-west of the shaft were driven in an attempt to locate the downward extension of the lode, but without success (Plan 10).

The Indicator is thus probably traceable in the mine workings from the surface to 3a sub-level, a vertical distance of 330 feet, and is exposed for a horizontal distance of 260 feet, mostly at the No.3 level.

The Leviathan Lode

The Leviathan Lode has been stoped out from the surface to the adit level, but these stopes are now inaccessible. They connect with the main drive on No.1 level immediately west of the junction of the main drive with the adit drive (Plan 11). The downward continuation of the ore shoot starts in a chamber between the main drive extension and the adit drive and is accessible from both. It appears therefore that the ore body has been displaced at this level. A flat-lying joint is visible in both drives dipping 30° northwards, and this joint forms the roof of the chamber between the drives. This chamber is known as sub-level 1c.

The workings beneath sub-level 1c consist of four small sub-levels 1d, 1e, 1f, and 1g, connected by vertical winzes. The bottom sub-level is 100 feet below the adit drive, and is therefore at the same depth as No.2 level, but they are not connected, and there is in fact 70 feet between sub-level 1g and the nearest drive on No.2 level.

The pattern of controlling fractures in the Leviathan Lode is difficult to distinguish. The main fractures in each sub-level are near vertical and strike north (Plan 11), but it is not clear to what extent these fractures actually formed the loci for mineralisation, as the distribution of black rock and tin is very irregular. At sub-levels 1c and 1f strongly developed flat-lying joints dip at 30° to 40° northwards. Some movement may have taken place on these.

The workings on the south end of No.3 and No.4 levels are not proved to be part of the Leviathan Lode but are described under this heading for convenience.

On No.3 level a short westerly crosscut from the southern end of the main drive has an inclined winze connection to No.4 level. This winze was sunk on an ore shoot of small dimensions, and a short rise was put up from No.3 level on the same shoot. The predominant fractures in this ore shoot dip steeply and strike north and north-east.

On No.4 level, where the inclined winze joins the main drive, abundant black rock occurs but there is no well defined lode and very little tin is apparent. The black rock ends northwards at a strong joint dipping steeply north-west. Black rock is found also at the northern end of the main drive, but ends northwards against a joint dipping steeply north. The lode material here was promising enough for a winze to be sunk and a sub-level drive (sub-level 4a) to be extended northwards. The black rock in this sub-level also ended against the downward extension of the north dipping joint. The black rock body in this area is tabular in form, as if related to a north striking fracture, but no such fracture is visible.

DISCUSSION

The chief problem in this mine is the location of the continuation of the Bradlaugh Lode, if it exists. Other problems concern the possibility of finding further ore in other parts of the mine, such as the possible continuation of the Leviathan Lode from sub-level 1g to No.3 level, or the possibility of a new lode or part of the Leviathan Lode in No.4 level.

The main Bradlaugh Lode is controlled by the north striking Indicator, which in places is one single fissure and in other places a zone five to ten feet wide of parallel fissures. The Indicator provided a good passageway for the mineralising agents and suitable conditions for widespread alteration of the neighbouring granite to form black rock, and in more localised areas, for the deposition of cassiterite. The ore-shoot is localised within the body of black rock lying along the Indicator, and is very roughly pipe-like in form, plunging southward. This corresponds to the behaviour of most of the ore-shoots in other mines in the area; in some mines they plunge north or split into two shoots. The localisation of the ore deposits into pipe-shaped bodies suggests that the ore might be controlled by the intersection of some other set of joints within the Indicator. No such joint set has been observed to intersect the Indicator in the mineralised areas, and the calculated intersections of the major joints plunge north, whereas the ore-shoot plunges south.

The mineralisation is controlled by the Indicator and must consequently be later than the formation of the Indicator. It is not so easy to determine the relationships of the other fissures to the ore deposit.

The north-east striking joint that displaces the indicator near the shaft on No.2 level is also mineralised and is therefore assumed to predate the mineralisation. This is supported by evidence from the Wild Irishman Mine, where the ore is controlled by north-east trending fissures and not the normal north-striking indicators (Broadhurst, 1951). However, in the Old Bradlaugh Mine these north-east striking joints form a sharp termination to the lode (main drive No.4 level, main drive No.2 level) which suggests that they did not always offer suitable conditions for mineralisation.

In the Bradlaugh Lode, a joint dipping gently north has displaced the Indicator and the ore-shoot near sub-level 2b, and possibly another similar joint is responsible for the displacement between the adit level and the surface. The lode bottoms on a similar joint at sub-level 3a. It is therefore important to have some idea of how these joints are related to the Indicator and the ore body, and since there is very little direct evidence within the mine to indicate how the flat joints have displaced the lode it will be necessary to consider evidence from neighbouring areas.

Flat-lying joints are widespread throughout the mines of the Herberton mining area, and have been repeatedly reported in the literature, where they are described as displacing the lode or forming the roof or the floor of the lode. A study of these reports reveals that in many instances the lode is of a different size on either side of the flat joint, and that there is often a marked difference in grade also, with a strong enrichment on one side or the other. Examples of these features can be seen in descriptions of the Canberra Mine, Rainbow Mine, Southern Cross Mine, Good Friday Mine, and many others (Ball, 1923, Reid, 1933, Broadhurst, 1951). In the Wild Irishman Mine one ore-shoot is terminated by a flat joint while the adjacent shoot about 20 feet away is unaffected.

In the Old Bradlaugh Mine a flat joint has terminated the lode at sub-level 3a, and no continuation of either the lode or the Indicator has been located beneath the joint, though the search has been concentrated in a westerly direction; it has not been exhaustive. The flat joint does not displace the probable Leviathan lode that has been worked between No.3 and No.4 levels, and cannot be found to intersect it at all. Where the Indicator

approaches the flat joint, the constituent north-striking joints tend to weaken until they almost disappear, and one of them has been observed to curve round and run into the flat joint.

These facts all point to the flat joints predating the mineralisation, since they do not merely displace the lodes but have some effect on the size and grade of the lode, and most of the other writers on the Herberton mines have recognised this. There is, however, no conclusive evidence to prove that the flat faults predate the indicators.

In nearly all the mines reported in the literature it appears that, where present, the downward continuation of the lode beneath a flat joint is found down the dip of the flat joint rather than up it.

From the foregoing it follows that the Bradlaugh Lode may not necessarily continue below the flat joint which terminates it at the 3a sub-level, or if it does continue it may not be of economical grade. However it might continue as strongly as ever, and the most likely direction for its reoccurrence would be down the dip of the flat joint.

RECOMMENDATIONS

1. In order to search for the continuation of the Bradlaugh Lode, sink the main shaft to 20 feet below No.4 level and drill exploratory holes in an eastward fan (NE, E, SE). It would be best if the holes were inclined downwards at about 35°, so that they run parallel to the flat joing above. The holes should be at least 30 feet long.

2. No.4 level. The short drive at 450N, 285W should be driven another 10 feet northwards beyond the east-west joint that cuts out the black rock, and an exploratory hole drilled westward, parallel to the joint, to test if there is any worthwhile continuation of the mineralisation north of the joint.

3. The mineralisation visible at the southern end of No.4 level may possibly have affected the Bradlaugh Indicator which possibly lies to the east. An exploratory drill hole or drive to the east, possibly along 350N to test if any lode occurs in this direction, is therefore recommended. Drill 50 feet either horizontally, or slightly depressed to get beneath the flat joint which may still persist in this area.

4. Prospect the Leviathan Lode between No.2 and No.3 level by diamond drilling a 100-foot hole from the south end of No.2 level at co-ordinates 405N, 182W. This hole should be depressed 20°, on a bearing of 260°. If an encouraging intersection is obtained with this hole then a second 100-foot hole, depressed 45°, bearing 250° should be drilled.

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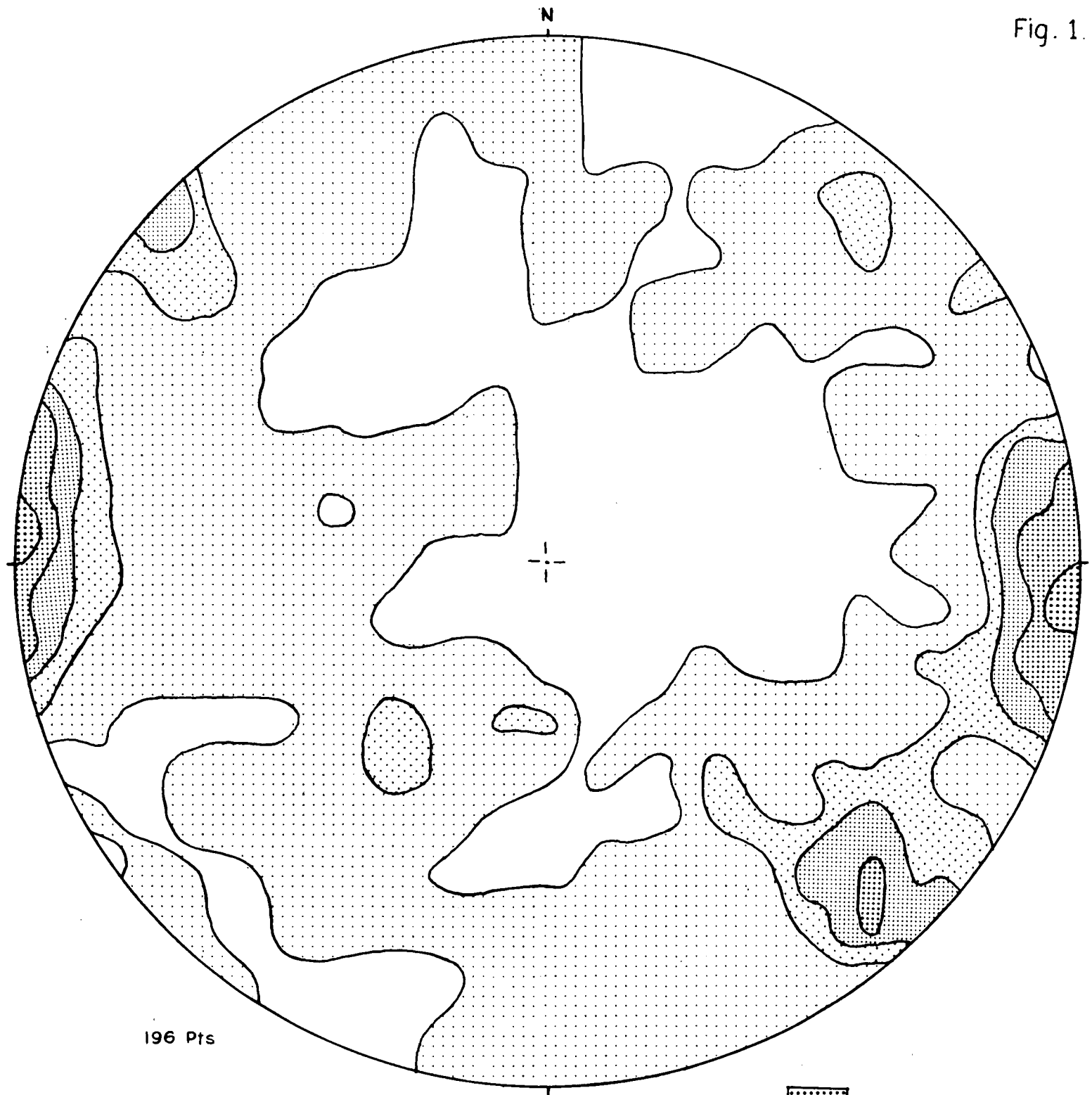
Fig. 1.



196 Pts

Old Bradlaugh Mine
Poles to joints (contoured)
(Mineralized & Unmineralized).

8 % per One percent Area
6-8
4-6
2-4
0-2

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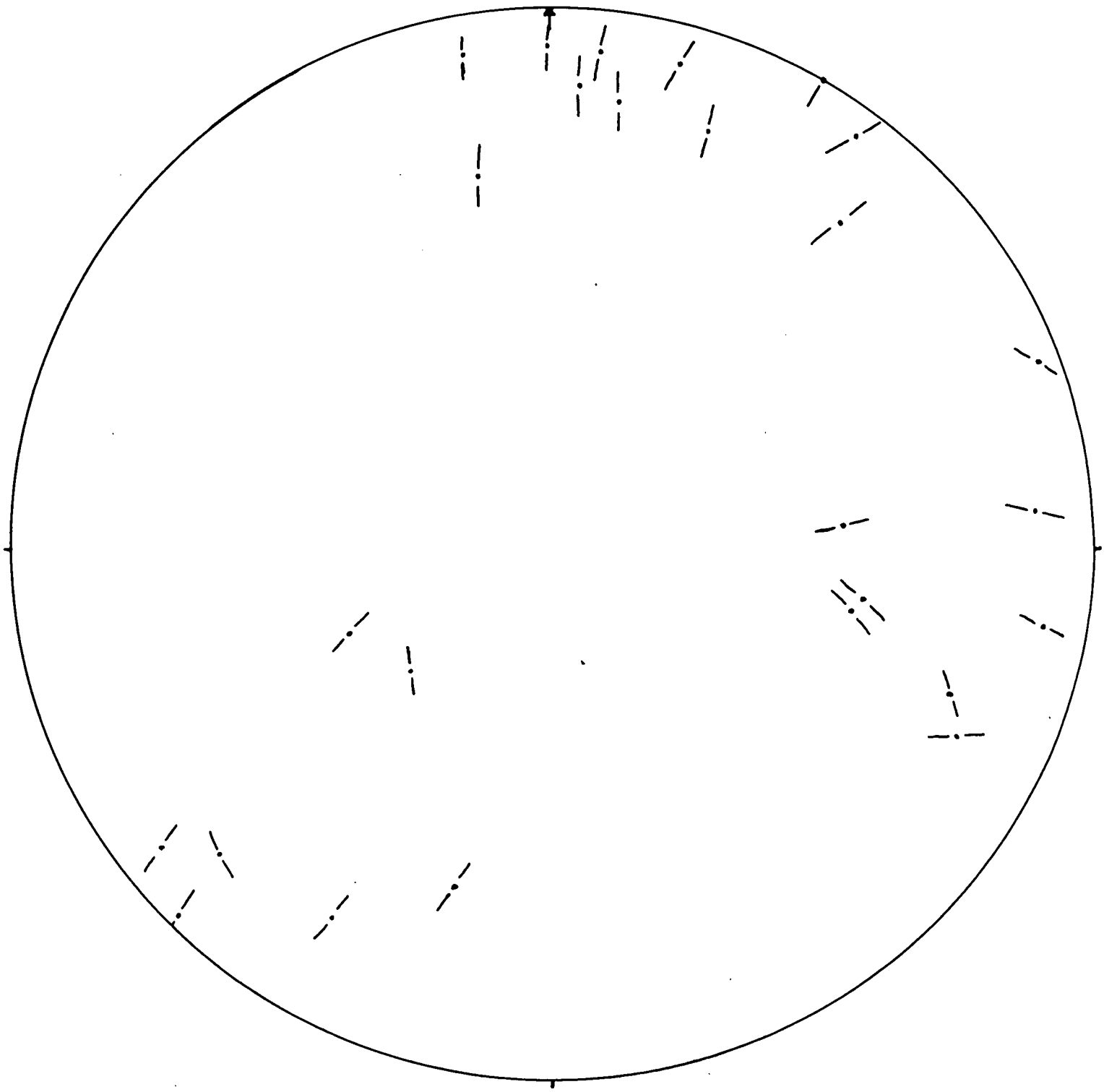
To accompany Record No 1963/111

E55/5/22

Fig. 2.



Old Bradlaugh Mine : Stereographic plot of slickensided joints

Points (•) are slickenside striae

Lines (— —) are the traces of the joints on which the striae occur

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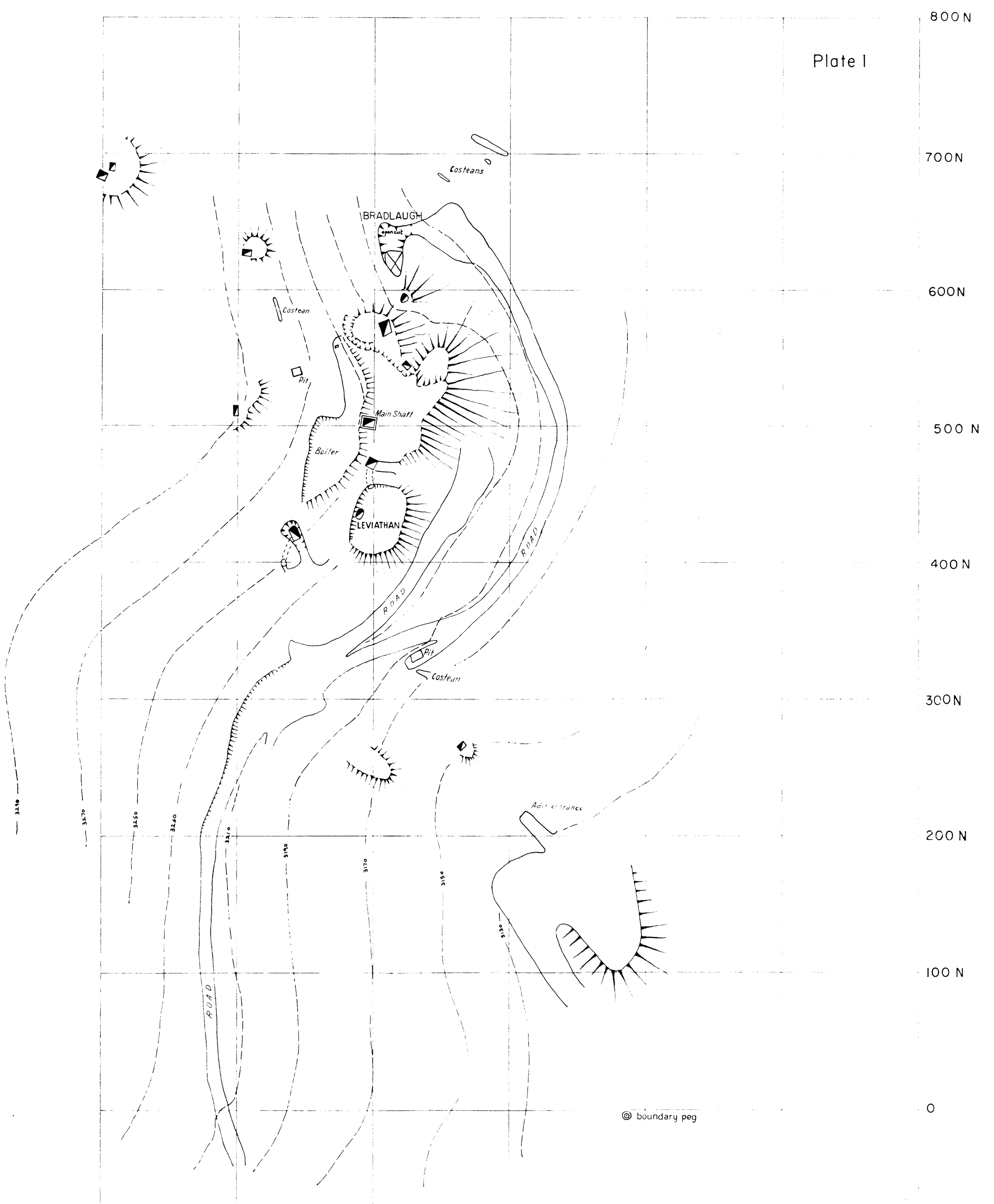
E55/5/23

Plate I



OLD BRADLAUGH MINE (U.B.M.)

Surface contours at 20' intervals.

Scale

40 0 40 80 FEET

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E 55/5/24

Plate 2

OLD BRADLAUGH MINE (U.B.M)

300W 200W 100W 0

600N 500N 400N 300N 200N

BRADLAUGH

Stoped above

Stoped below

Fill (Mullock)

MAIN SHAFT

270'

LEVIATHAN

Stoped above

Flat roof in drive 3°/355 extends eastward as roof of sub-level.

Access to Sub-levels 1c to 1g

VERTICAL RISE

Portal

No1 Level (Adit)

Sublevel 1a

SHAFT

Fill (Mullock)

Sublevel 1b

Stoped above and below

VERTICAL WINZE

SHAFT

Fill (Mullock)

Blackrock

Granite

40 0 40 80 120 FEET

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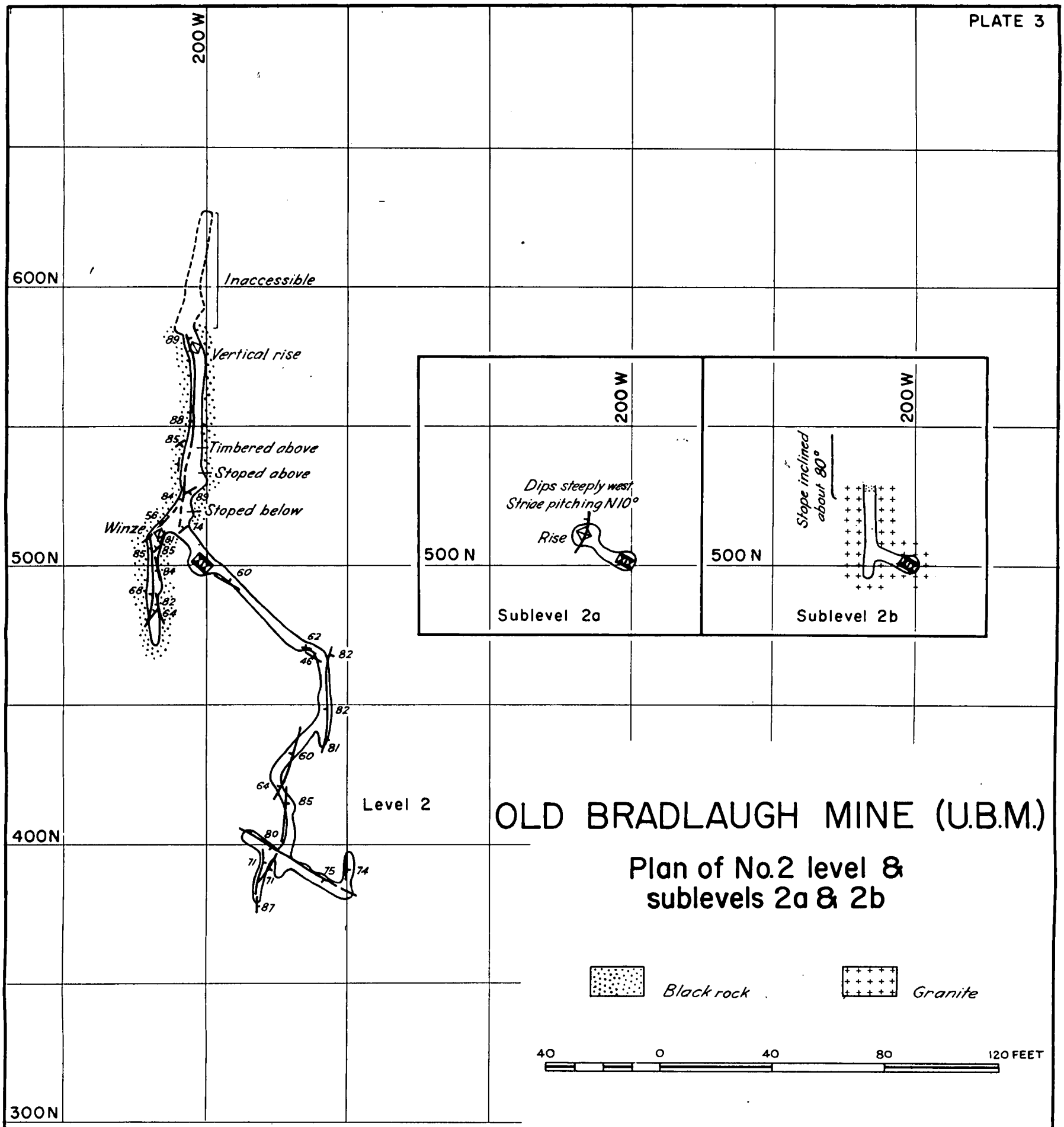
E55/5/31

G.M.

PLATE 3



OLD BRADLAUGH MINE (U.B.M.)

Plan of No.2 level & sublevels 2a & 2b

Black rock

Granite

40 0 40 80 120 FEET

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E55/5/29 PB

Plate 4

300W

200W

200W

600N

500N

400N

600N

500N

No 3 Level (200Ft)

Inaccessible

Winze

Stoped above and below

MAIN SHAFT

Blackrock with tin

Blackrock and granite

6" blackrock

Blackrock

Cut off by shear on East

Shearing

Sublevel 3a

Stoped above

Drive 5' above floor, stoped above

Drive 6' above level

Vertical rise above flat head on floor

6' winze in floor

Fill (Mullock)

Floor formed by flat head

MAIN SHAFT

Rise from 270ft level

Ore pass downward

OLD BRADLAUGH MINE (U.B.M.)

Blackrock

Granite

40 0 40 80

FEET

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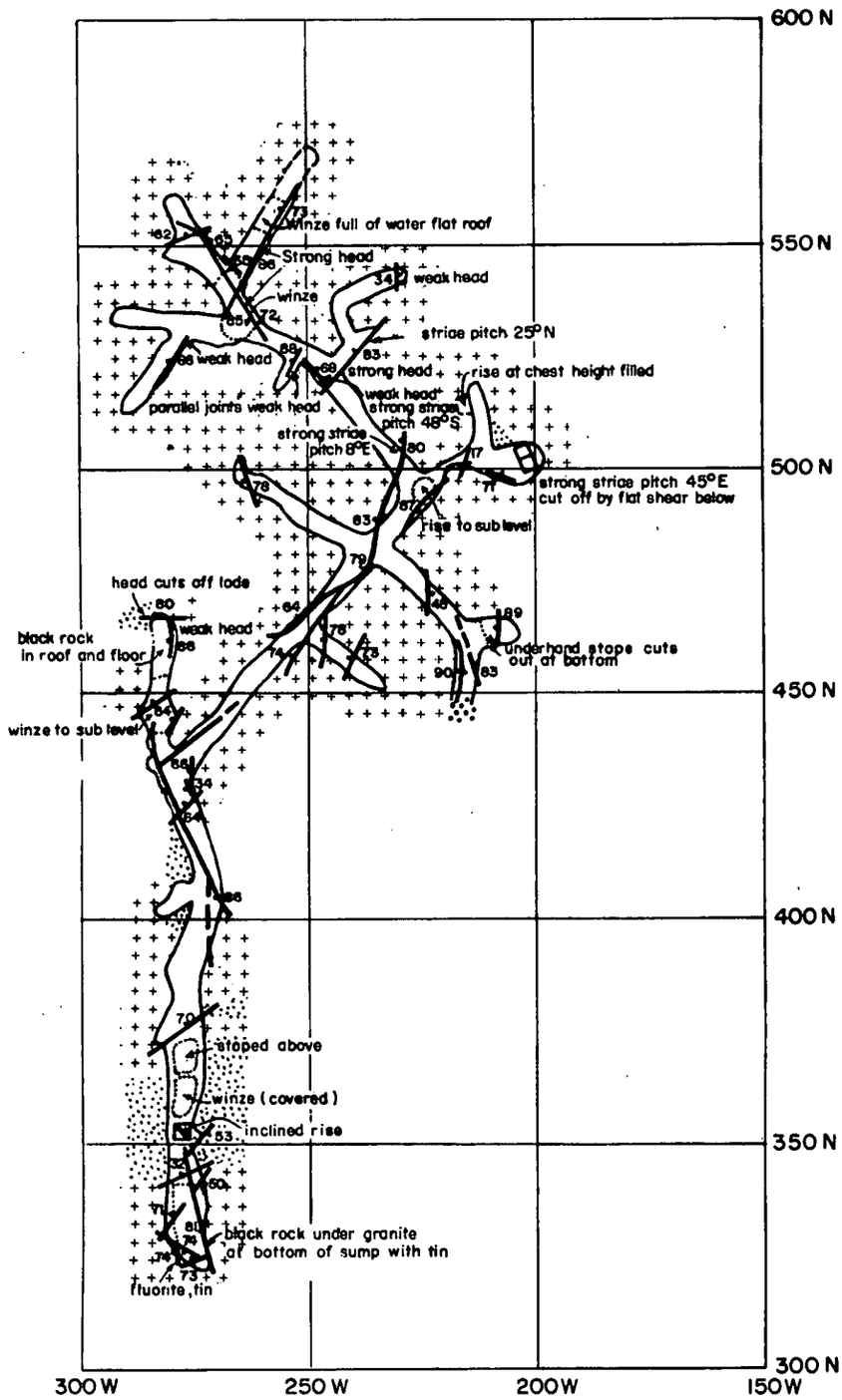
E55/5/32 G.M.

OLD BRADLAUGH MINE (U.B.M.)

No 4 Level (270 ft.)



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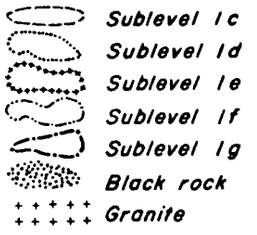
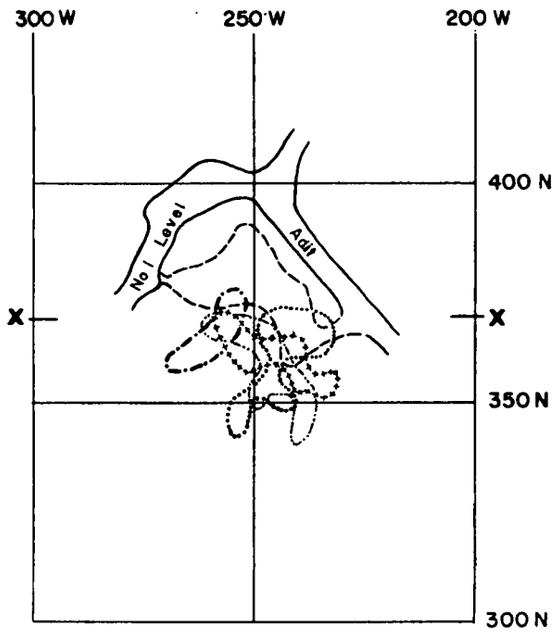
E 55/5/30 JK

OLD BRADLAUGH MINE, LEVIATHAN LODE

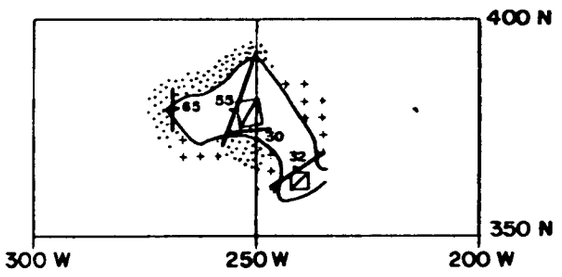
Plans of Sublevels

Reference

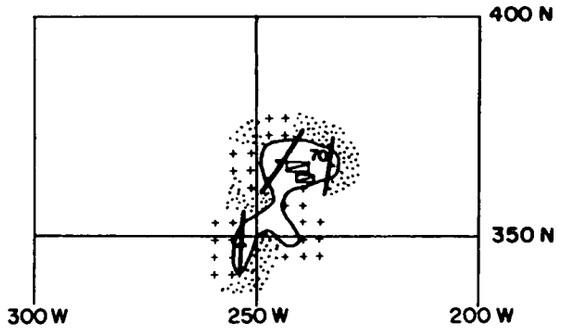




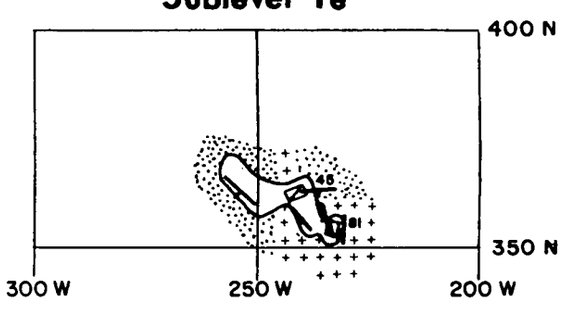
Sublevel 1c



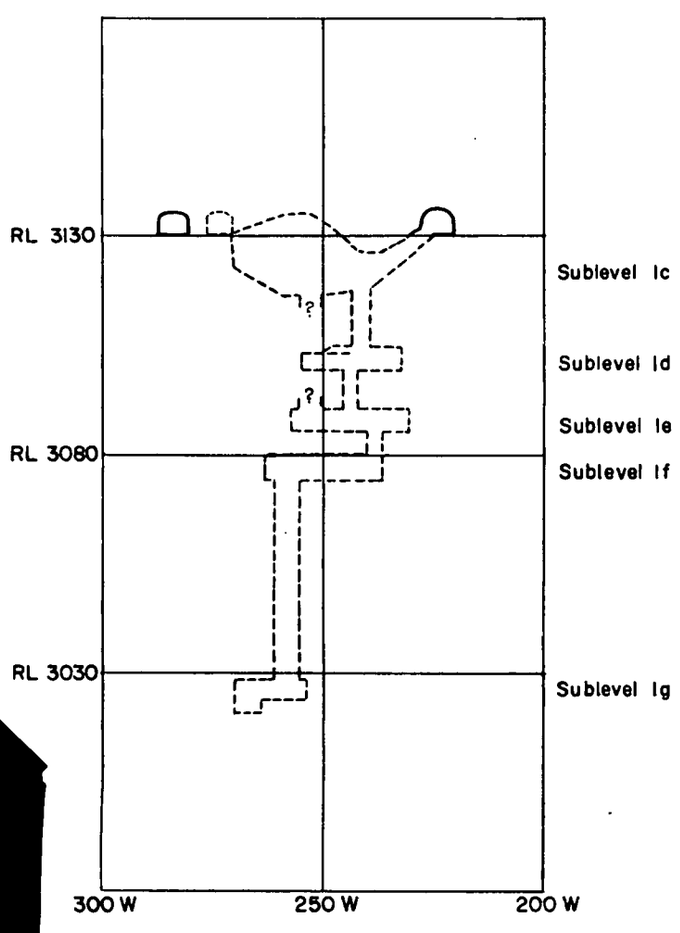
Sublevel 1d



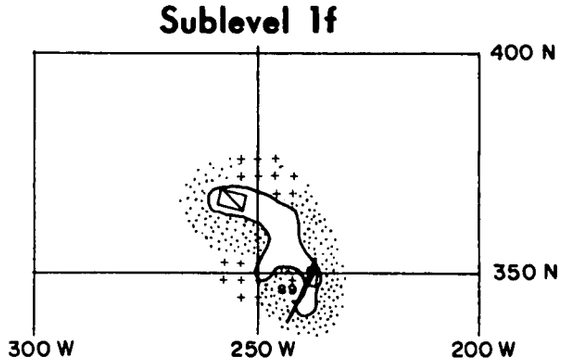
Sublevel 1e



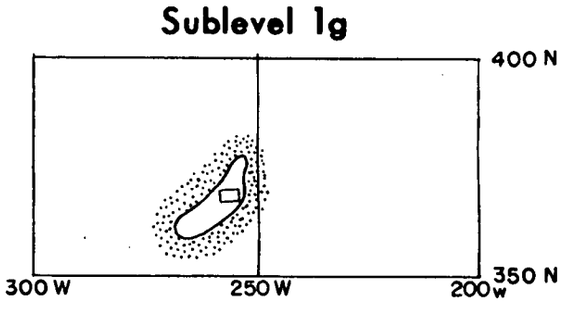
Section X-X'

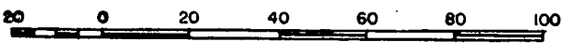


Sublevel 1f



Sublevel 1g





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E 55/5/25 JK

OLD BRADLAUGH MINE (U.B.M.)

SECTION A

Generalized N–S Longitudinal Section

Plate 7

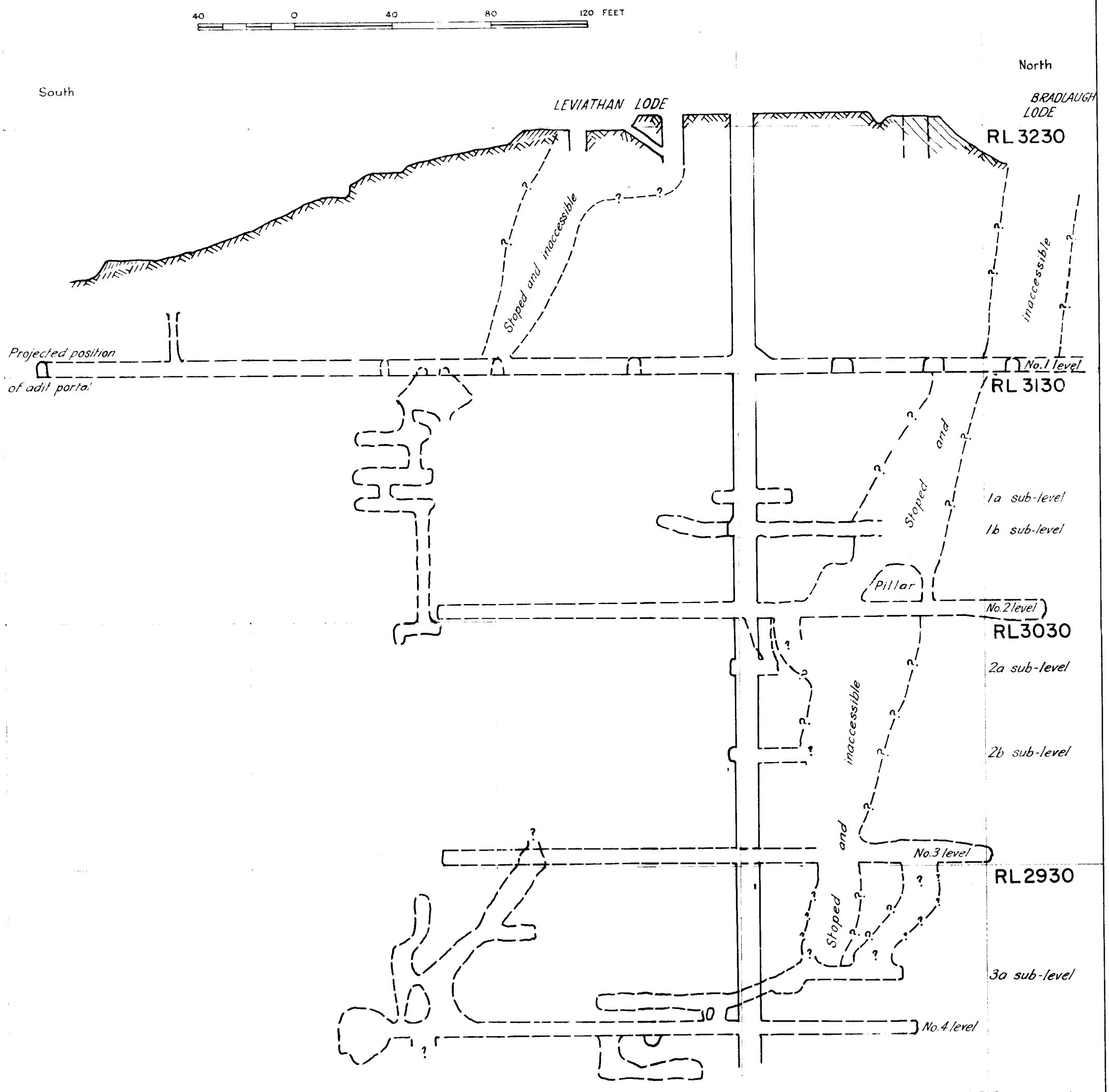

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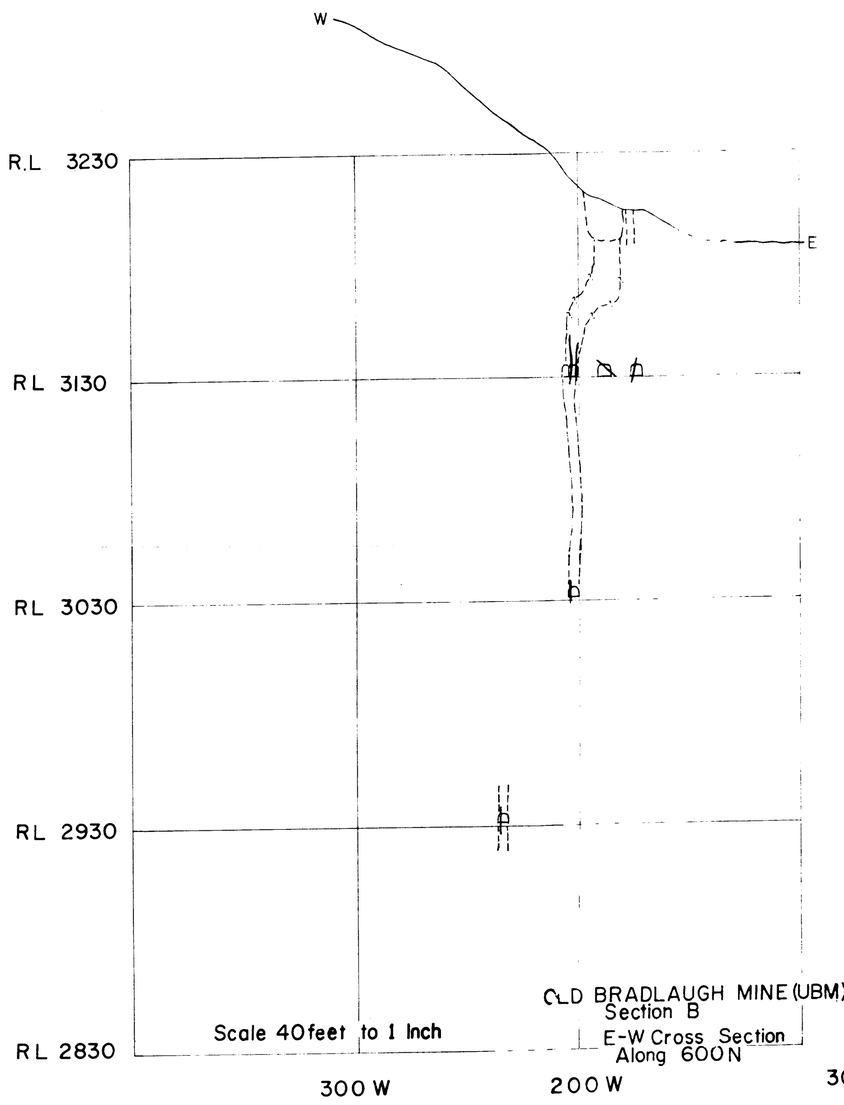
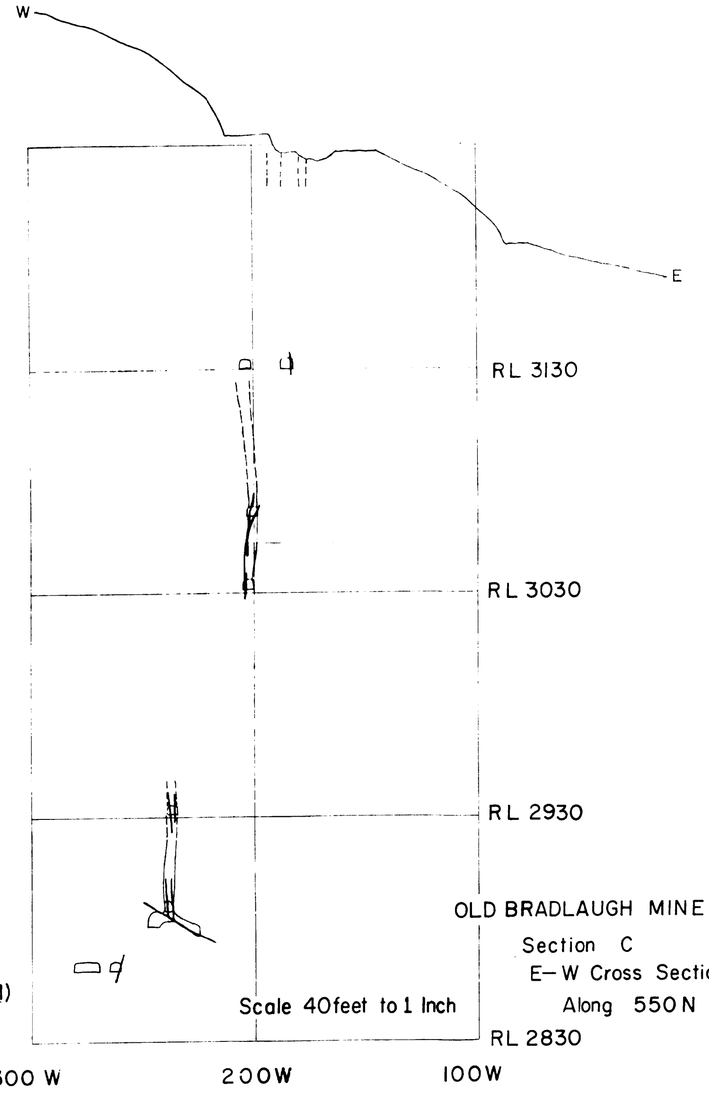
PLATE 8



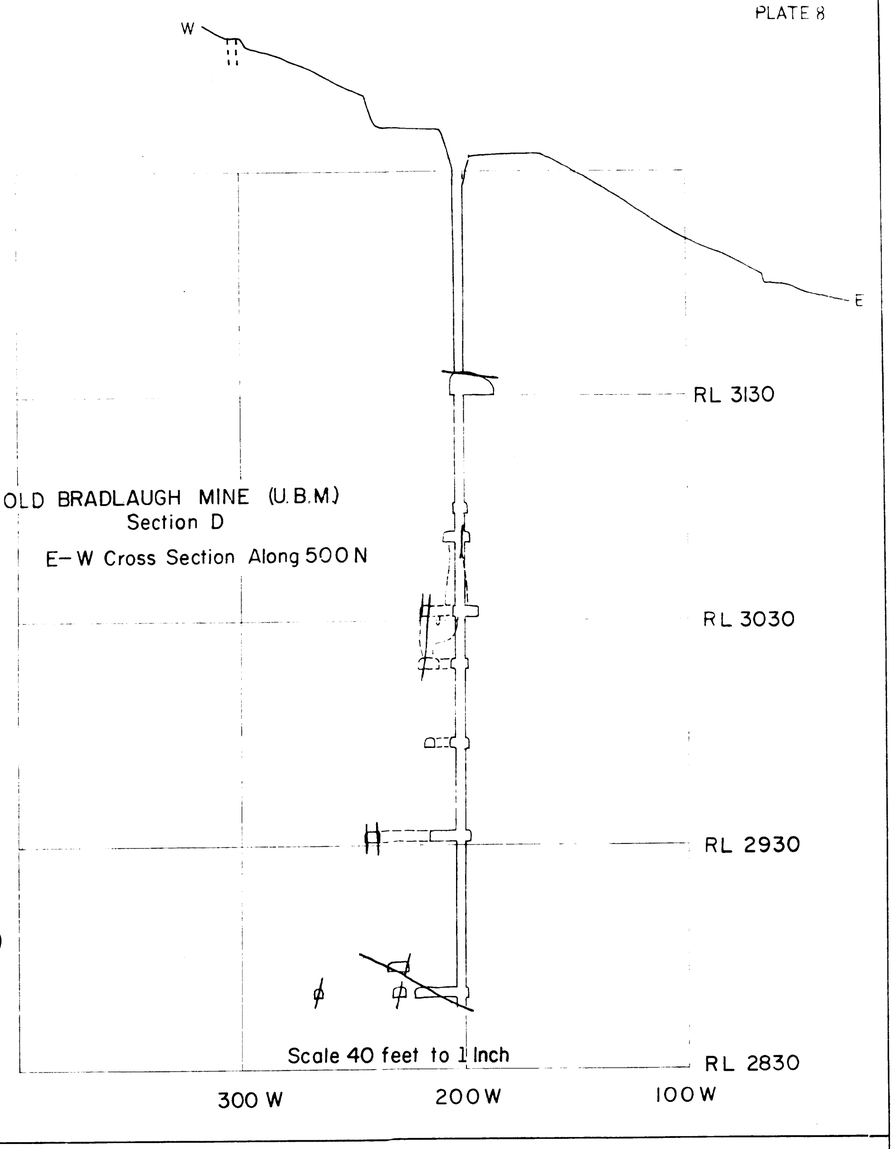
OLD BRADLAUGH MINE (UBM)
Section B
E-W Cross Section
Along 600N

Scale 40feet to 1 Inch



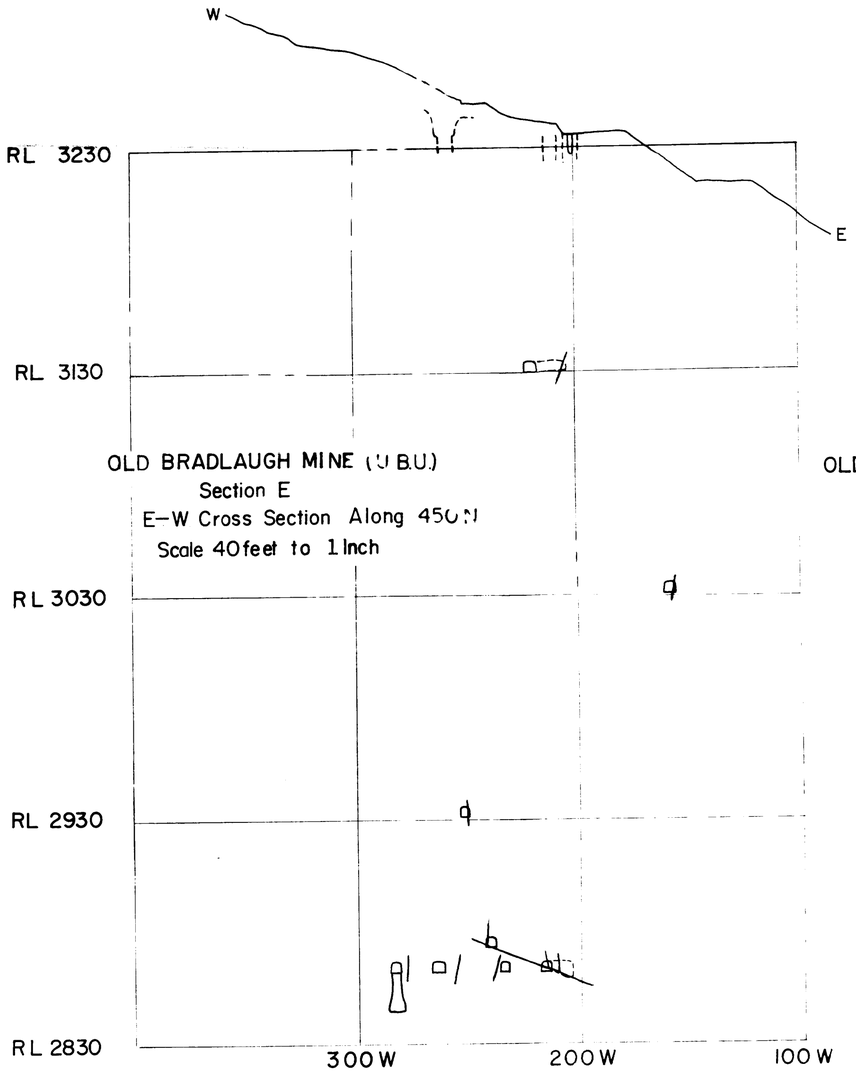
OLD BRADLAUGH MINE (U.B.M.)
Section C
E—W Cross Section
Along 550 N

Scale 40feet to 1 Inch

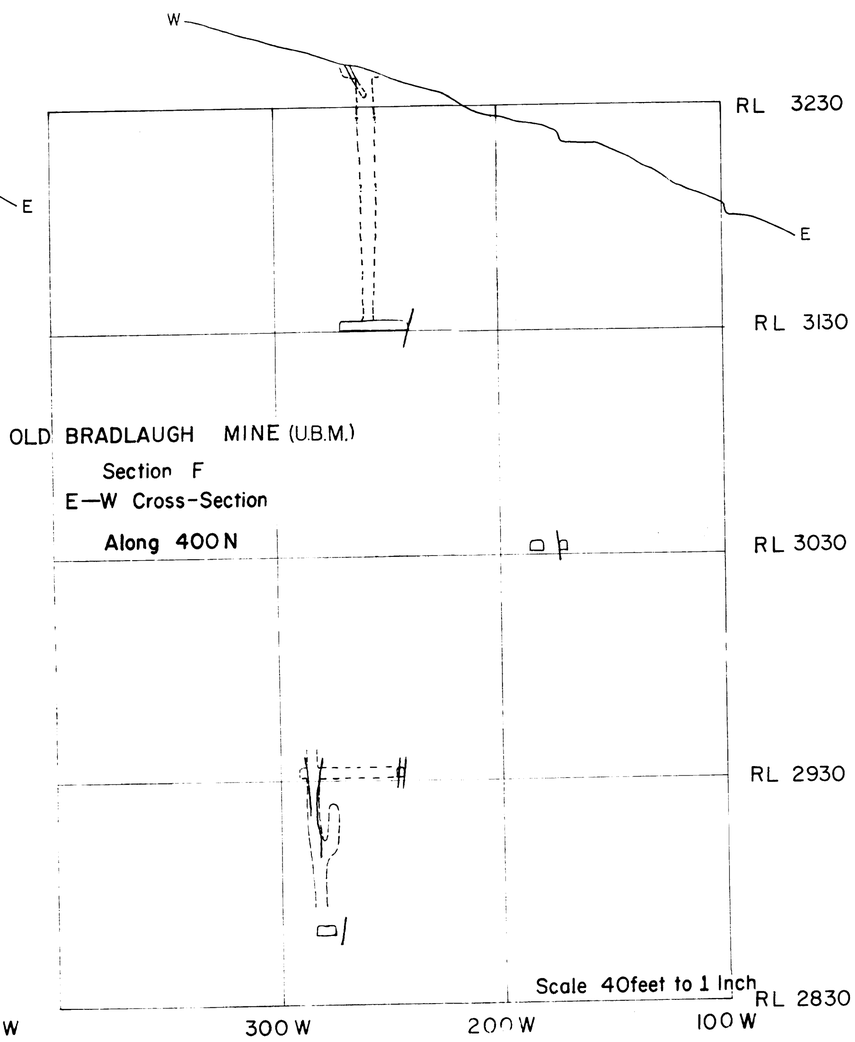


OLD BRADLAUGH MINE (U.B.M.)
Section D
E—W Cross Section Along 500 N

Scale 40 feet to 1 Inch

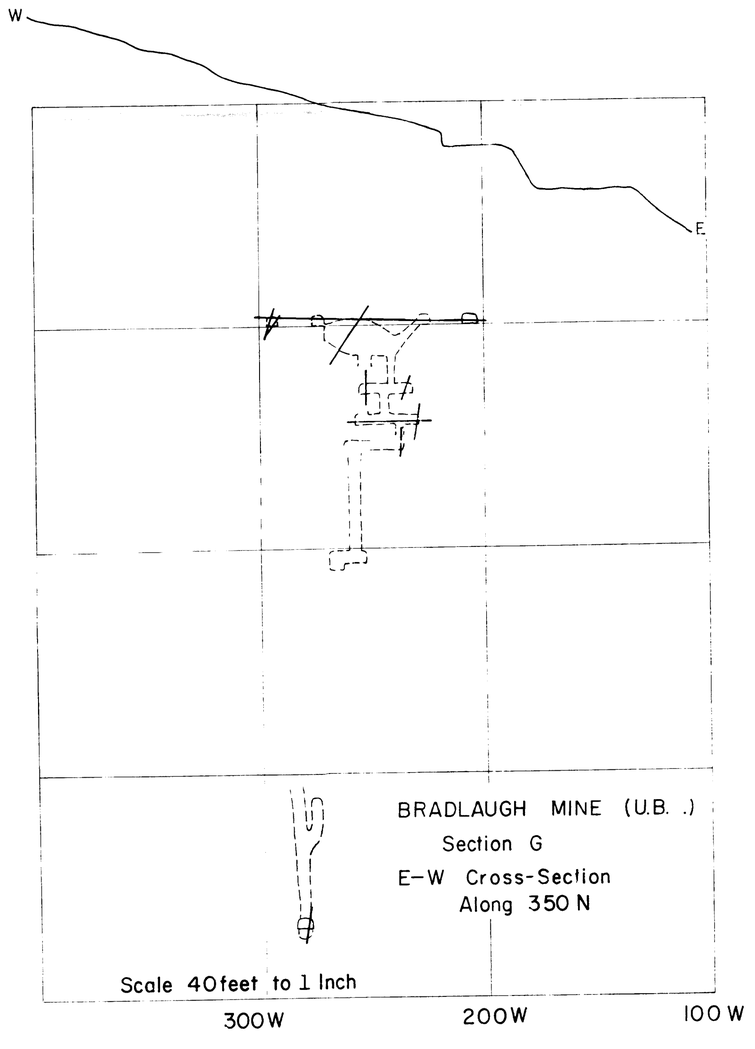


OLD BRADLAUGH MINE (U.B.U.)
Section E
E—W Cross Section Along 450 N
Scale 40feet to 1 Inch



OLD BRADLAUGH MINE (U.B.M.)
Section F
E—W Cross-Section
Along 400 N

Scale 40feet to 1 Inch



BRADLAUGH MINE (U.B. .)
Section G
E—W Cross-Section
Along 350 N

Scale 40feet to 1 Inch

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