PBSHLOC.DOC 1 August 1996

A Discussion of Some Inferences Concerning The Locations of Disused Lead Mines in Shropshire

by
James R Warren BSc MSc PhD PGCE

Acknowledgements

The following treatment depends very heavily upon the records reproduced in "The Mines of Shropshire and Montgomeryshire with Cheshire and Staffordshire"[1] by Roger Burt, Peter Waite and Roy Burnley. This is one of a series of monographs, one for each orefield region, which collate the British metal mining statistics gathered by the Mining Record Office between 1845 and 1913. Each of these books is a superb work of scholarship.

In the remainder of this paper I shall abbreviate this reference as "Burt". This should not be interpreted as a derogation of the contributions of the co-authors. I contend that several of the Burt statistics are erroneous, especially the Ordnance Survey mine grid references. This can only be regarded as inevitable given the nature of the survey population. I shall attempt to signal these errors and to describe their mathematical characteristics but readers should beware that the correction offered, if any, is not necessarily definitive.

All criticisms made attach of course to the referenced report and not to any individual or institution.

I am also grateful to the staff of The Shropshire Records and Research Centre at Shrewsbury, England for allowing me to consult microfiche facsimiles of the relative 1883 12" (more precisely 1/2500) County Series Ordnance Survey maps which I call "1883 series" in this paper; and also sheets of the corresponding 1978 1:10000 series which I shall call "1978 series".

Introduction

It appears that Burt locates mines on the basis of the subaerial emergence of their Main Engine Shaft or principal adit or equivalent high-status point manifestation. At any event, I am following such a convention.

This is of course rather unscientific because the chief orebodies hewn may have been many hundreds of meters from such features.

The men who could have led us on to an English heathland and put a name to a hole or proudly displayed a rich flat of galena glistening in our candlelight are all long dead. Many were illiterate. Few kept records. Most mines

were one or two man scratchings often made by those whose main paying job was agrarian. When the Government agent asked them questions their reply would be colored by their expectation, whether of taxation or subsidy.

In the later part of the life of the Shelve Plateau orefield The Earl of Tankerville and limited liability companies were active. These larger entities certainly recorded all commercial statistics and much underground mapping. Many of these details now seem lost, though we hope they are merely mislaid. When consolidation occurred the purchasing entity frequently destroyed the records of the subsidiary, sometimes as a policy act. This is known to have occurred in maritime trade and we can be confident that our very land-locked captains would have followed suit.

We are therefore fumbling our way to knowledge through a fog of uncertainty about location, production and employment, let alone geology. This is not, however, a pure clean fog such as you might expect on a Marcher upland but a cloud stained with ignorance, fraud and neglect every bit as annoying as the sooty and sulfurous damp of the old time lead smelters.

The Locations of the Shropshire Lead Mines

Appendix One tabulates the mines in order of cumulative production together with their Grid References according to Burt and this researcher (Warren). A further column lists the Euclidean distance (in meters) between the two grid references and beside this is a column of the Logarithm of Euclidean Distance (LED).

The Warren references, issuing with the assistance of the 1978 series, are eight-figure and are therefore of theoretical ten-meter accuracy, whereas the Burt are conventional six-figure references for one hundred meter accuracy.

In addition I found seven shafts or adits on or near the plateau whose grid references are given below the main list.

The grossest error occurs where Burt assigns Ritton Castle co-ordinates to Pennerley, sites separated by some 1.5 kilometers. This can only be a clerical error, but is strange in view of the blatancy with which sites appear on OS maps even at the 1:25000 scale. Ritton Castle is flagged by a motte and bailey earthwork boldly labeled "Ritton Castle" in Old English script. Pennerley is signified with a large waste tip either side of the motorable road though this is easy to miss if you are driving in Summer due to the hedgerows.

The siting of the Hope Valley, Batholes and North Tankerville workings is more understandably uncertain in view of the extensive field of abandoned shafts and adits across the Hope Valley area. Note that North Tankerville is not really near Tankerville. North Tankerville and Snailbeach New

West are the same mine, but it is not very near Snailbeach either. The name was changed from North Tankerville in 1889 when it was clear that the star of the 60's, Tankerville, was as good as finished whilst the Snailbeach Mine was holding its own. It was very common for firms to latch onto the names of star competitors in those pre- Trade Mark days, but more usual for companies which needed to excite shareholder interest than for sole proprietors.

The Grit Mine could realistically be anywhere along a well-worked vein between SO 319981 and SO 327982.

A group of mine locations differ by around a hundred meters. This matter will be discussed in detail later.

The least difference of opinion occurs for mines with very conspicuous surviving features, especially well-constructed Victorian chimneys. The acme of this is the twenty-meter difference in locating The Walker Shaft of The Tankerville Mine marked by a wonderful Victorian brick chimney shown smoking in an 1871 photograph reproduced in "Mining in Shropshire"[2] and represented in its virtually perfect current state in the lovely drawing by Malcolm Newton published in the same book.

The farm of Stapeley is at SO 312984 as recorded in Burt. Nevertheless I consider that the mine locus is likely to be on the other side of Stapeley Hill at SO 30849912 where levels marked on the 1987 1:25000 Pathfinder map probably occur in a small sheep-proof enclosure. Stapeley recorded 768.7 tons of lead ore of which 74.87% was metal in the years 1864-1866. Staveley is almost certainly at or near the same place and recorded 40 tons of lead ore 77.5% metal in 1866.

A complex of shafts North-East of Tankerville centered about SO 35909966 appears to have been sunk after the 1883 series was surveyed. This may of course be associated with late attempts to sustain the Tankerville Mine itself. Just down the brae at SJ35870000 is a feature called Boatlevel marked on the 1883 series. It is possible it was quite literally that. Eighteenth-century lead miners frequently dammed the efflux of adits with low sills to create a shallow but navigable sough along which a boy was hired to wade trows loaded with excavate. Wet issue is marked on the current Pathfinder map. Burt makes no mention of this feature and it is likely that it was abandoned before 1845.

Using the 1883 series microfiche I detected small workings near Meadowtown. In a walled-off field corner at SJ 31100141 a disused lead shaft is marked whilst a little further East at SJ 31460146 a level is marked. Nothing further is known of these.

Returning to the Plateau New Central Mine at Crowsnest formed a conspicuous 1883 series feature on the road between Snailbeach and Tankerville. It looked prosperous and it is a pity Burt does not give details since it would appear to be a strategic point on the apparent geologic axis Callow Hill-Snailbeach-Tankerville-Bog. This working appears to identify with The Central

Snailbeach Mine (SJ 368016) figured in another fine drawing by Malcolm Newton on Page 84 of "Mining in Shropshire".

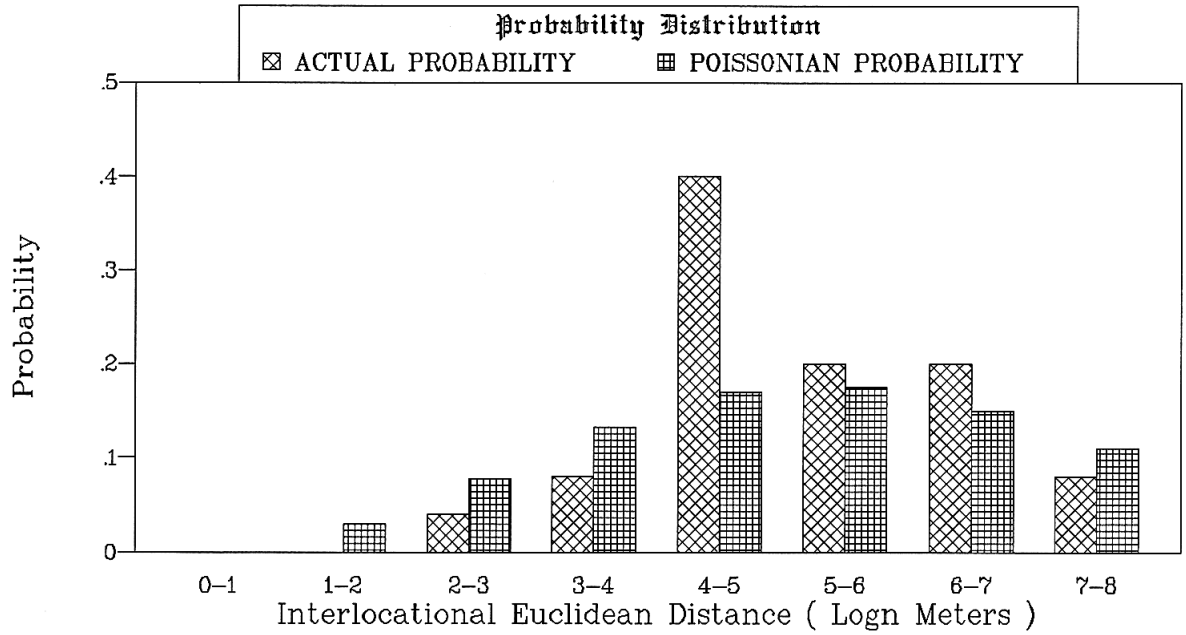
Off the Shelve Plateau there are several minor mines of obscure history. The most productive comprised two isolated shafts on a hill top near Crickheath a little way from Oswestry (SJ 27302360 and SJ 27232383). Both were disused in 1883 but brought 85 tons of lead ore of 72.25% metal and 60 tonnes of zinc ore to grass in the following year when twelve were employed. Nearer the main action at Callow Hill several shafts existed. The most central was at SJ 38520492 but only appears on the 1883 series having been later dug away by open-cast quarrying. There is a surviving shaft at SJ 38680491 which was disused on the 1883 series. Burt says that a total of four and a half tons of lead and zinc ore was raised by two men in 1890-91. There was a brief but unproductive reworking underground just before The First War. Though essentially a barytes mine Bulthy raised a ton of lead ore in 1885. It is a shaft situated in a little covert in a very remote valley meters on the English side of the Anglo-Welsh border (SJ 30981332). It is marked disused on the 1883 series and it is very likely that the 230 tons of barytes produced that year came from a shaft (SJ 30901326) and a level (SJ 30911332) both of which are a few meters away on the other bank of a little stream and are technically in Wales. Absurdly, the outfit styled itself "North Snailbeach" in 1881-82, undoubtedly a stock market gimmick. (The mine is 12.9 kilometers as the crow flies from Snailbeach). Work ceased forever in July 1894.

An Analysis of Locational Errors

Because of the extreme uncertainty of the location of the Stapeley working an error analysis has been performed both with and without Stapeley. The Stapeley co-ordinates were however employed in drafting the comparative histograms of Figure One.

DIFFERENCES OF OPINION IN
THE LOCATION OF SHROPSHIRE LEAD MINES
Figure One

A Comparison with a Poisson Model



Drafted by James R Warren

The uncertainty in (grid reference) location was specified in terms of the Euclidean Distance, d, between a Burt and a Warren fix and given by:-

$$d = \sqrt{(x_b - x_w)^2 + (y_b - y_w)^2} \qquad \textbf{Eqn.1}$$

In order to suppress inconvenient data "slurring" this was immediately transformed to:-

$$L = \log_n d \qquad \textbf{Eqn.2}$$

A Grouped Frequency Distribution (GFD) was then erected for the 24 or 25 known values of L for the eight Class Intervals L=0-1;1-2;2-3;3-4;4-5;5-6;6-7;7-8.

For the 25-point with-Stapeley series this GFD appears as the Actual Probability (empirical probability) histogram of Figure One.

Actual or Empirical Probability is calculated as:-

$$p_{a,j} = \frac{m_j}{M} \qquad \textbf{Eqn.3}$$

and:-

$$\sum p_{a,j} = 1$$

by definition.

An assumption was then made that the distribution of LED's, considered as errors, was completely random.

This was tantamount to postulating a Poissonian probability distribution according to:-

$$p_{p,j} = \frac{e^{-\mu}.\mu^{j}}{j!} \qquad \textbf{Eqn.4}$$

The degree of agreement of the two parallel series of probabilities was then assessed in terms of their Pearsonian Coefficient of Correlation[3]:-

$$r = \frac{n\sum p_{a,j}.p_{p,j} - (\sum p_{a,j})(\sum p_{p,j})}{\sqrt{\left[n\sum p_{a,j}^{2} - (\sum p_{a,j})^{2}\right]\left[n\sum p_{p,j}^{2} - (\sum p_{p,j})^{2}\right]}} \qquad \textbf{Eqn.5}$$

In order to attempt a partition between the components of variation accounted for by Random and Systematic Error I considered it convenient to compute r^2 as The Coefficient of Variation.

Before we explore r^2 relationships we should try to explain a large anomaly on our GFD histogram comparison Figure One. You can see that the empirical probability is essentially consistent with the Poissonian assumption of random errors in our LED's except for the LED interval four to five where there "ought" to be about four or five mines and not the ten actually in this class.

As aforementioned Burt cites grid references to six figures after the letter code giving in theory a precision to one hundred meters on the flat ground. I give eight-figure references implying another order of magnitude's precision to ten meters. This means that for any correct Burt fix rounded to the nearest third figure East or North I could correctly choose up to five ten-meter intervals short or up to five ten-meter intervals long of it, making a latitude of ten ten-meter intervals in all which of course equals one hundred meters.

If then both Burt and I give "correct" fixes the expectation is that they will differ by one hundred meters.

This particular component of Systematic Error we may call The Precision Component.

Is the GFD anomaly consistent with the presence of a Precision Component?

In order to explore this problem we should develop a more accurate expression of the LED attaching to the frequency anomaly by computing the mode of the empirical GFD. This is done by the traditional graphical

construction in Figure Two. The two intersecting broken lines can be expressed as simultaneous equations whose solution yields the usual equation:-

$$x = x_{lb} + \frac{f_1 - f_0}{2f_1 - f_2 - f_0} \qquad \textbf{Eqn.6}$$

For x_{lb}=4 and f_0=2, f_1=10, f_2=5 the computed mode x=4.615384615. To express this in meters along the ground we exponentiate giving e^x=101.0266775 meters.

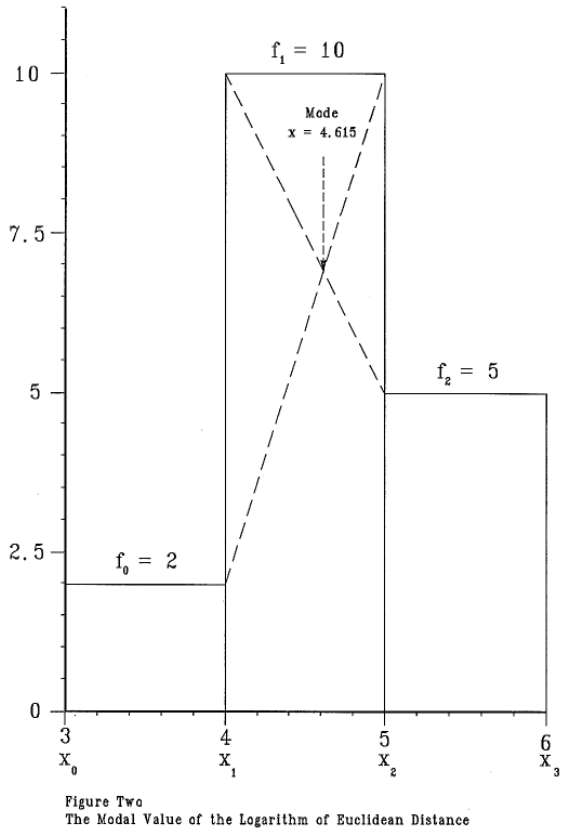


Figure Two
The Modal Value of the Logarithm of Euclidean Distance

The GFD anomaly is therefore entirely consistent with Precision Effects. Stapeley makes no difference.

Some readers are doubtless wondering why the Precision Effect should amount to 100 meters and not the Euclidean distance attaching to the two-dimensional range across 100 meters of latitude and 100 meters of longitude: A matter of some 141 meters. Well, to hypothesise that diagonal distance would be tantamount to suggesting a *coherence* between the Easting and Northing as if they were related by some law. We are assuming that errors in estimating the Easting and the Northing are *uncoupled* and *independent*: Hence the hundred-meter criterion.

We can now return to our partitioning of the error according to r^2

relationships.

We shall do so by classifying values of r^2 in Table One both for the unadjusted empirical probabilities and also for the condition in which the modal actual probability is replaced by its Poissonian expectation. Furthermore we will cite r^2 for series with and without the problematic Stapeley:-

r^2	Stapeley	
	With	Without
Actual	0.656537	0.637579
Adjusted	0.849184	0.881040

Table One
A Table of the Coefficient of Determination

Stapeley or no, more than 63% of the variation in the two workers' fixes is random. The amount of the residue which can be accounted for by The Precision Component varies from about 19.3% assuming my Stapeley fix makes sense to 24.3% discounting Stapeley. A tabular breakdown of the implied partitioning is given in Table Two:-

r^2	Stapeley	
	With	Without
Random Factors	0.656537	0.637579
The Precision Component	0.192647	0.243461
Residual Systematic Factors	0.150816	0.118960

Table Two
Error Partitioning for the Locational Data

As you can see even if Stapeley is excluded there remains some 11.9% of the variation in the data accounted for by Residual Systematic Factors. I regard this figure as too large to be an artifact of the small population size, but I have no idea what the sources of this residual procedural error might be.

Mapping the Mines

Appendix Two presents a map of twenty-seven Shropshire lead mines at a scale of 1:100000 in its original A4 format. The mines are ranked in descending order of cumulative metal production. They are segregated on that basis into three groups according to the mathematical principles developed in my 1995 paper "The Distributional Characteristics of Lead Mine Yields".

When the logarithm of the cumulative production of each mine is related to its rank the most productive in Statistical Province One lie along a cubic polynomial curve; Statistical Province Two mines describe a quadratic; whilst the least productive mines in Statistical Province Three lie along a classical Zipfian straight line.

The mines show no areal segregation on that basis, but it appears from the Appendix Two map that there are two distinct cartographic lines along which mines developed: A straight NE-SW axis from Callow Hill to Rhadley, and a shorter E-W line from Rorrington to Perkins Beach. The Most prolific mines tended to form at the intersection near to Tankerville.

This map was based upon Burt co-ordinates, and as he explains in his preface to "The Mines of Shropshire" etc his convention is to assign the fix of the nearest likely mine to mine names he cannot positively locate. This has the unfortunate effect of occluding locational problems until plotting is attempted.

Appendix Three presents a map of thirty-six mines ranked in descending order of production to Bulthy at Position 35. Seven additional shafts or levels of unknown production are plotted but not classified. The co-ordinates used are those determined by myself. Again the mines show no segregation by Statistical Province in the sense developed in my 1995 paper but it can be seen that the simple model of a linear disposition of workings has dissolved. In its stead a more complex but also more interesting and unusual picture has developed. A curving line of mines is manifest between Rhadley and Hope Valley via Bog. I have called this feature the Stiperstones Arcuate Feature (SAF). Strictly speaking it is not of course arcuate: It may be parabolic or otherwise curvilinear. More careful study identifies a Ladywell Arcuate Feature (LAF) between Hope Valley and White Grit, a Stapeley Arcuate Feature (TAF) between Rorrington and White Grit, and the almost rectilinear Snailbeach Arcuate Feature (NAF) between Callow Hill and Ritton Castle. Lastly, and perhaps most enigmatic of all, is the Shelve Arcuate Feature between Ritton Castle and Meadowtown.

These Arcuate Features are overlaid upon the Appendix Two map in the map of Appendix Three. The trajectories of the broken lines have no rigorous scientific status: I drew them by eye using the DraftChoice bezier function. We may however note that they appear to meet almost orthogonally at nodes or intersections where the most prolific mines developed. The two great

intersections are:-

Tankerville	NAF-SAF
Roman Gravels	LAF-VAF

and the three nodes:-

Hope Valley	LAF-SAF
White Grit	LAF-TAF
Ritton Castle	NAF-VAF

Conversely, poor mines are associated with the extremities of the arcuate features.

It is tempting to regard these features as geologic fault lines (mechanical tears along and within the Earth's crust). Certainly the mines of the Snailbeach Arcuate Feature nestle at the base of the Stiperstones Western escarpment. Such pronounced curvilinearity would be unusual in faults but it should be remembered that in three dimensions faults are sheets and tend to refract into quasi-cylindrical surfaces under the stress of lithostatic overburden or even conchoidal hollows under epicentral stress. We may also recall that many of the old time captains, especially in Cornwall, associated fault intersections with bonanza.

I consider that these features are consistent with the powerful rise of a magmatic dome in a remote eon when the rocks of the plateau were very deeply buried but already of an indurated and possibly recrystallised fabric. Extending this rather conservative geological interpretation it appears that the mineralisation was later emplaced in conchoidal fractures by magmatic fluids, possibly expelled by the cooling pluton.

If this is tenable other arcuate members of these two orthogonal families may not be impossible and I speculate that the most prolific of all the Shropshire mines, Snailbeach, may intersect a NW-SE trending arc buried beneath the Stiperstones quartzite in the East and the overburden South of Ploxgreen in the West.

If production figures for Ritton Castle (renamed Wentnor in 1860) were available new light may be shed upon a central node.

Notation

d	A Euclidean Distance
e	The Napierian Base
f_0	The Frequency of the Submodal Class
f_1	The Frequency of the Modal Class

f_2	The Frequency of the Supermodal Class
j	The (Integral) Class Interval Upper Bound
L	The Logarithm of Euclidean Distance (LED)
μ	The Arithmetic Mean of the LED's
m_j	The Number of Mines in the Class with Upper Bound j
M	The Total Number of Mines
n	The Number of Class Intervals
$p_{a,j}$	The Empirical Probability for the Class Interval with Upper Bound j
$p_{p,j}$	The Poissonian Probability for the Class Interval with Upper Bound j
x	The Modal LED
x_b	A Mine Easting according to Burt
x_{lb}	(The LED attaching to) The Modal Interval Lower Bound
x_w	A Mine Easting according to Warren
y_b	A Mine Northing according to Burt
y_w	A Mine Northing according to Warren

References

1 "The Mines of Shropshire and Montgomeryshire with Cheshire and Staffordshire"
Roger Burt, Peter Waite and Roy Burnley
The University of Exeter Press of Exeter 1990
ISBN 0-85989-343-X

2 "Mining in Shropshire"
Edited by Adrian Pearce
Shropshire Books of Shrewsbury 1995
ISBN 0-903802-63-5

3 "Standard Mathematical Tables"
Twenty-Fourth Edition 1976
Edited by William H Beyer
CRC Press of Cleveland
ISBN 0-87819-623-4

Appendix One

A List of Shropshire Lead Mines
With Their Grid References according to
Burt and Warren
and their Interlocational Euclidean Distances

LOCATIONAL GRID REFERENCES
OF THE
SHROPSHIRE LEAD MINES
With Euclidean Distances between Burt and Warren Fixes

SERIAL NUMBER	MINE	GRID REFERENCE (BURT)	GRID REFERENCE (WARREN)	EUCLIDEAN DISTANCE	LN EUCLIDEAN DISTANCE (LED)
1	SNAILBEACH	SJ375022	SJ37470215	58	4.065765
2	RG	SO334998	SO33319992	150	5.010635
3	TANKERVILLE	SO355995	SO35529950	20	2.995732
4	PENNERLEY	SO345977	SO35379893	1507	7.317601
5	STIPERSTONES		SO35649707		
6	WHITE GRIT	SO319980	SO32039805	139	4.936514
7	BOG	SO356978	SO35829784	224	5.409889
8	GRIT	SO320980	SO32729802	720	6.579637
9	ROUND HILL	SO351996	SO35069968	89	4.493598
10	RG EAST	SJ334002	SJ33550023	153	5.030246
11	TA WEST	SJ334002	SJ33310020	90	4.499810
12	OVENPIPE	SO355995			
13	PERKINS BEACH	SO365998	SO36639981	130	4.870484
14	BATHOLES	SJ335003	SJ34260068	850	6.744890
15	LADYWELL	SO327993	SO32779922	106	4.666279
16	STAPELEY	SO312984	SO30849912	805	6.690823
17	HOPE VALLEY	SJ334002	SJ34020083	884	6.784357
18	RORRINGTON	SO306997	SO30599979	91	4.505945
19	LEEDS ROCK	SO349962	SO34919618	22	3.107304
20	BOG SOUTH	SO349962			
21	SALOP SOUTH				
22	POTTERS PIT	SO355994	SO35559920	206	5.328630
23	CRICKHEATH	SJ273233	SJ27302360	300	5.703782
24	STAVELEY				
25	BURGAM	SO358996			
26	LORD HILL		SJ37450205		
27	TA NORTH	SO351996	SJ34290070	1366	7.219681
28	RG SOUTH	SO342996	SO34229969	92	4.523911
29	RHADLEY	SO343957	SO34349565	64	4.159371
30	WHITE GRIT EAST		SO32359811		
31	BATHOLES OLD	SJ335003	SJ33800060	424	6.050356
32	RG WEST		SJ33310020		
33	SN NEW WEST (as TA NORTH)	SO351996	SJ34290070		
34	CALLOW HILL	SJ385049	SJ38520492	28	3.342306
35	BULTHY	SJ309133	SJ30981332	82	4.412339
36	RITTON CASTLE		SO34439776		
37	SHELVE		SO33949915		
38	NEW CENTRAL MINE (CROWSNEST)		SJ36790154		
39	MEADOWTOWN 1		SJ31100141		
40	MEADOWTOWN 2		SJ31460146		
41	TANKERVILLE NORTH-EAST		SO35909966		
42	BOATLEVEL		SJ35870000		

Appendix Two

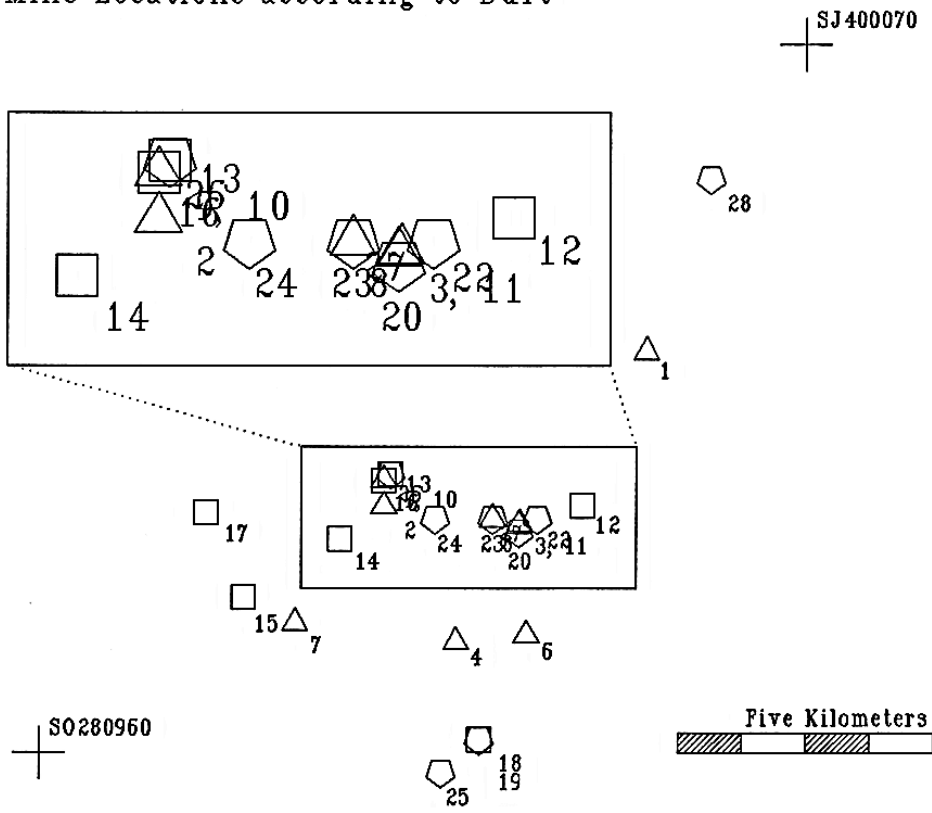
A Map of Shropshire Lead Mines
Based upon Burt Co-ordinates

SOME LEAD MINES OF THE SHROPSHIRE OREFIELD
Plotted by Statistical Province

Mines are Ranked in Descending Order of Total Metallic Lead Production

Statistical Province One : Triangles
Statistical Province Two : Squares
Statistical Province Three : Pentagons

Mine Locations according to Burt



1	SNAILBEACH	
2	ROMAN GRAVELS	
3	TANKERVILLE	
4	PENNERLEY	
5	WHITE GRIT	(Not Shown)
6	BOG	
7	GRIT	
8	ROUND HILL	
9	ROMAN GRAVELS EAST	
10	TANKERVILLE WEST	
11	OVENPIPE	
12	PERKINS BEACH	
13	BATHOLES	
14	LADYWELL	
15	STAPELEY	
16	HOPE VALLEY	
17	RORRINGTON	
18	LEEDS ROCK HOUSE	
19	BOG SOUTH	
20	POTTERS PIT	
21	CRICKHEATH	(Not Shown)
22	BURGAM	
23	TANKERVILLE NORTH	
24	ROMAN GRAVELS SOUTH	
25	RHADLEY	
26	BATHOLES OLD	
27	SNAILBEACH NEW WEST	
28	CALLOW HILL	
29	BULTHY	

Drafted by James R Warren

Appendix Three

A Map of Shropshire Lead Mines
Based upon Warren Co-ordinates

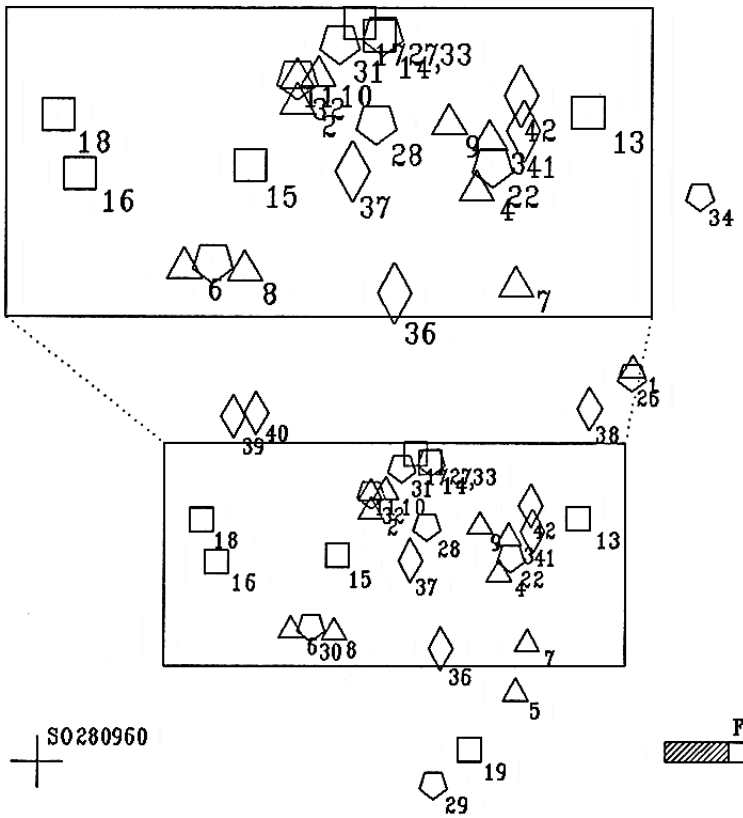
SOME LEAD MINES OF THE SHROPSHIRE OREFIELD

Plotted by Statistical Province

Mines are Ranked in Descending Order of Total Metallic Lead Production
(Except that Productions for Mines 36 to 42 are Unknown)

Statistical Province One : Triangles
Statistical Province Two : Squares
Statistical Province Three : Pentagons
Unclassified Mines : Lozenges

Mine Locations according to Warren



1	SNAILBEACH	
2	ROMAN GRAVELS	
3	TANKERVILLE	
4	PENNERLEY	
5	STIPERSTONES	
6	WHITE GRIT	
7	BOG	
8	GRIT	
9	ROUND HILL	
10	ROMAN GRAVELS EAST	
11	TANKERVILLE WEST	
12	OVENPIPE	(Not Shown)
13	PERKINS BEACH	
14	BATHOLES	
15	LADYWELL	
16	STAPELEY	
17	HOPE VALLEY	
18	RORRINGTON	
19	LEEDS ROCK	
20	BOG SOUTH	(Not Shown)
21	SALOP SOUTH	(Not Shown)
22	POTTERS PIT	
23	CRICKHEATH	(Not Shown)
24	STAVELEY	(Not Shown)
25	BURGAM	(Not Shown)
26	LORD HILL	
27	TANKERVILLE NORTH	
28	ROMAN GRAVELS SOUTH	
29	RHADLEY	
30	WHITE GRIT EAST	
31	BATHOLES OLD	
32	ROMAN GRAVELS WEST	
33	SNAILBEACH NEW WEST	
34	CALLOW HILL	
35	BULTHY	
36	RITTON CASTLE	
37	SHELVE	
38	NEW CENTRAL MINE (CROWSNEST)	
39	MEADOWTOWN 1	
40	MEADOWTOWN 2	
41	TANKERVILLE NORTH-EAST	
42	BOATLEVEL	

Drafted by James R Warren

Appendix Four

A Map of Shropshire Lead Mines Based upon Warren Co-ordinates with Arcuate Features Plotted

⬠35 SOME LEAD MINES OF THE SHROPSHIRE OREFIELD

Plotted by Statistical Province

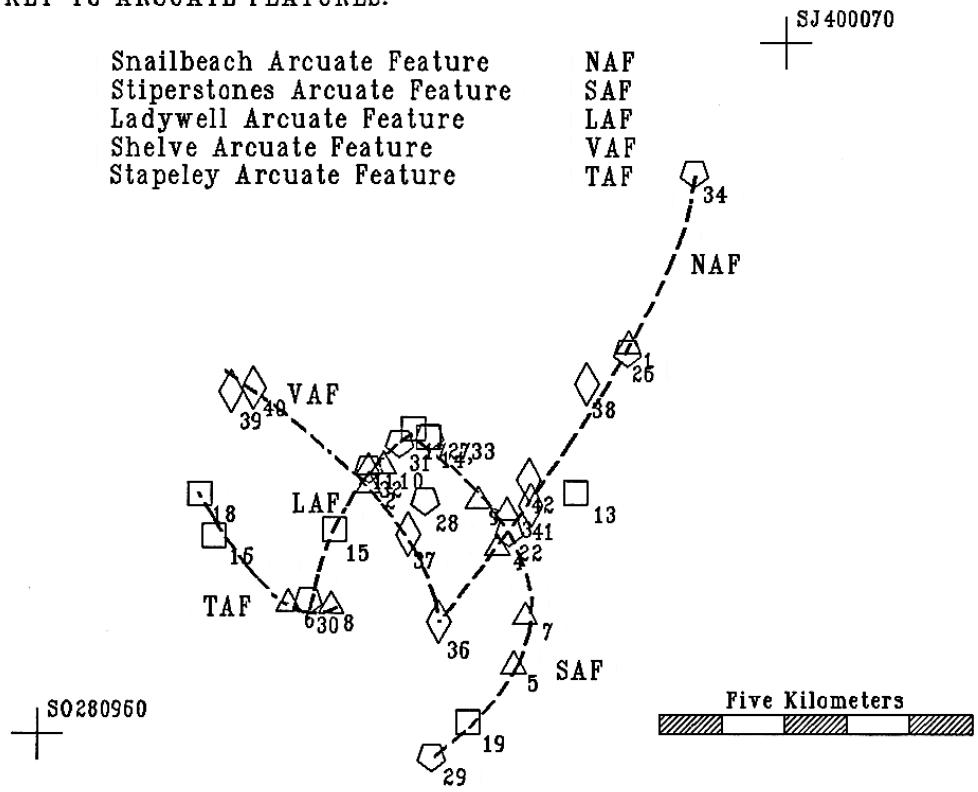
Mines are Ranked in Descending Order of Total Metallic Lead Production
(Except that Productions for Mines 36 to 42 are Unknown)

Statistical Province One : Triangles
Statistical Province Two : Squares
Statistical Province Three : Pentagons
Unclassified Mines : Lozenges

Mine Locations according to Warren

KEY TO ARCUATE FEATURES:

Snailbeach Arcuate Feature	NAF
Stiperstones Arcuate Feature	SAF
Ladywell Arcuate Feature	LAF
Shelve Arcuate Feature	VAF
Stapeley Arcuate Feature	TAF



1	SNAILBEACH	
2	ROMAN GRAVELS	
3	TANKERVILLE	
4	PENNERLEY	
5	STIPERSTONES	
6	WHITE GRIT	
7	BOG	
8	GRIT	
9	ROUND HILL	
10	ROMAN GRAVELS EAST	
11	TANKERVILLE WEST	
12	OVENPIPE	(Not Shown)
13	PERKINS BEACH	
14	BATHOLES	
15	LADYWELL	
16	STAPELEY	
17	HOPE VALLEY	
18	RORRINGTON	
19	LEEDS ROCK	
20	BOG SOUTH	(Not Shown)
21	SALOP SOUTH	(Not Shown)
22	POTTERS PIT	
23	CRICKHEATH	(Not Shown)
24	STAVELEY	(Not Shown)
25	BURGAM	(Not Shown)
26	LORD HILL	
27	TANKERVILLE NORTH	
28	ROMAN GRAVELS SOUTH	
29	RHADLEY	
30	WHITE GRIT EAST	
31	BATHOLES OLD	
32	ROMAN GRAVELS WEST	
33	SNAILBEACH NEW WEST	
34	CALLOW HILL	
35	BULTHY	
36	RITTON CASTLE	
37	SHELVE	
38	NEW CENTRAL MINE (CROWSNEST)	
39	MEADOWTOWN 1	
40	MEADOWTOWN 2	
41	TANKERVILLE NORTH-EAST	
42	BOATLEVEL	

Drafted by James R Warren