SIROTOPE

CSIRO
Division of Mineralogy and Geochemistry
Sydney Laboratory

Delhi Road, North Ryde
P.O. Box 136, North Ryde, NSW, Australia 2113
Intl. Phone: 61-2-887 8712, 61-2-887 8713
Telex: MINRE AA 25817

REPORT

TO

CORPORATION FALCONBRIDGE COPPER

ON

THE SIGNIFICANCE OF LEAD ISOTOPIC COMPOSITIONS

OF

SAMPLES FROM PROSPECTS AND DEPOSITS IN BRITISH COLUMBIA

JUDITH A. DEAN
GRAHAM R. CARR
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Commonwealth Scientific and Industrial Research Organization, Australia

1. AIMS OF STUDY

The aims of this study have been:

1. To analyse samples from the Proterozoic clastic-hosted Sullivan Mine in southeastern B.C. to supplement a small amount of existing data from the SIROTOPE database and LeCouteur, 1973.

2. To determine target Pb isotope ratios for Silurian-Devonian deposits in central Vancouver Island by analyses of samples from Westmin Resources Buttle Lake deposit and to compare other deposits and prospects in southern Vancouver Island with this target value.

3. To determine the target Pb isotope ratios for volcanogenic massive sulfide mineralization of Upper Mesozoic age in southwestern B.C. as given by samples from the Britannia Mine (located 60 kms north of Vancouver) and the Northair Mine, and to compare these with other prospects hosted by Gambier Group volcanics. Some of these prospects are thought to be volcanogenic massive sulfides similar to Britannia, although some are likely to be vein related. It has also been an intent of this study to relate the presumed Lower Triassic North Forks prospect to the younger Gambier Group rocks.

2. SAMPLES

1. Samples from the Sullivan Mine consisted of six pulps, four representing massive mineralization and containing > 9 wt % Pb, and two from altered wallrocks (Table 1).

2. Seven pulverised samples with varying lead contents from several horizons in the Mount Sicker property were analysed (Table 2). Six mineralized samples from two mines at Buttle Lake, the Lynx and the HW Mines, provided material for determining target Pb isotopic values (Table 2).

3. Two mineralized samples from the Northair Mine with high lead concentrations and four samples from the Britannia Mine provided material for determining target Pb isotope values (Table 3). Samples from five prospects hosted by Gambier volcanic pendants within the Coast Range Batholiths and one prospect hosted by the Lower Triassic Chilliwack volcanics are given in Table 3.

3. TARGETS

As has been noted, a major intention of this work has been to establish isotopic targets for Precambrian, Palaeozoic and Mesozoic mineralization in the region. A small amount of data has previously been available for the Sullivan deposit. Also, data on Devonian SEDEX mineralization from the Selwyn Basin are available from SIROTOPE'S database as well from Godwin and Sinclair, 1982 and Godwin et al., 1982.

Target ellipses are computer calculated and drawn. They define the mean + 2*SD of the target data.

4. METHODS

All samples were digested in a 1:1 mixture of 7N hydrochloric acid and 7N nitric acid prior to ion exchange and electroplating onto Pt electrodes. The samples were analysed on an ISOMASS 54E solid source thermal ionization mass spectrometer in fully automated mode. Precision estimates representing 2 standard deviations about the mean of over 700 analyses of standards are shown in the top left hand corner of the Figures which follow.

5. RESULTS

1. *Samples from the Sullivan Mine.* The five high-Pb samples, representing massive mineralization and altered wallrocks, from

the Sullivan mine (Table 4, Figures 1 and 2), form as expected a homogeneous population with Pb isotope ratios that are the same as galenas previously analysed. The single low Pb sample (analysed in duplicate) is more radiogenic (i.e. higher $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios). The combined data (this study, CSIRO galenas and data from LeCouteur, 1973) form a well constrained target signature for Precambrian massive sulfide mineralization in the region.

2. *Samples from Vancouver Island.* Lead isotope results of all samples from Vancouver Island, British Columbia are given in Table 5.

The samples from Buttle Lake in central Vancouver Island were analysed to define a target Pb isotopic signature for the massive sulfide mineralization. The two highest lead samples, 3976 (from the Lynx Mine with a Pb content of 9200 ppm) and 3981 (from the HW Mine with 505 ppm Pb) have the same Pb isotope ratios within experimental error. The data for all but one of the other samples plot close to this value but have slightly lower $^{206}Pb/^{204}Pb$ ratios (i.e. they are less radiogenic). Sample 3977 with 115 ppm Pb has a significantly lower $^{206}Pb/^{204}Pb$ ratio than the other samples.

In Figures 3 and 4 the data for the Buttle Lake samples have been plotted. The target signature, defined by ellipses which represent the distribution of the target data (mean + 2*SD, or 95% confidence domains), is drawn around all samples excluding 3977. For comparison the target ellipses for the Sullivan mineralization and for Devonian Cordilleran mineralization from Howards Pass have been plotted.

The samples from the Mount Sicker prospects on southern Vancouver Island are plotted in Figures 5 and 6. Three of the samples, all from the Lenora-Tyee horizon fall within the target ellipses for Buttle Lake. These represent two mineralized samples and one sample from the quartz ore with a lead content of only 124 ppm. The other samples are all less radiogenic than the target value and, together with 3977 from the Buttle Lake mine, define a linear trend on a $^{208}Pb/^{204}Pb$ versus $^{206}Pb/^{204}Pb$ diagram (Fig. 5) which projects back towards the Precambrian Sullivan Pb isotope target. Sample 3623 (chert and pyrite containing 640 ppm Pb) approches this value and has the least radiogenic lead of all the samples.

All data from Vancouver Island plot below the Pb evolution curves for massive sulfide deposits, indicating that the source rocks for these leads have lower U/Pb and Th/U ratios than the average crust.

3. *Samples from southwestern British Columbia.* Lead isotope results of all samples from the Britannia District are given in Table 6.

The samples from the *Britannia Mine* and the *Northair Mine* were analysed to define a target Pb isotope signature for volcanogenic massive sulfide mineralization occurring in Gambier volcanic pendants of Mesozoic age within the Coast Range Batholiths. The three samples with the highest lead contents from the Britannia mine have Pb isotope ratios that are the same, within experimental error. The lowest lead sample has a value which is slightly less radiogenic but still within experimental error. The two samples from the Northair Mine have the same ratios and correspond to the low lead sample from the Britannia Mine. Despite these very small differances, the leads from both mines are considered to be the same and this data is used to define the target ellipses (Figs 7 and 8).

Three samples from the *Roy Showing*, a Gambier hosted chalcopyrite-rich remnant sringer zone, fall in a tight cluster within the target ellipse on both plots (Figs 9 and 10). The sample lowest in lead, R-4 with 68 ppm, is slightly more radiogenic (higher $^{206}Pb/^{204}Pb$ ratio) but still plots within the target field. (Note: No sample details were received for sample R-4; it is presumed that it is from the Roy Prospect).

Both samples from the *Maggie Mines* prospect are the same and have Pb isotope ratios which lie in the target ellipses in both plots (Figs 9 and 10).

The two highest lead samples from the *Red Tusk* prospect, RT-MZ and RT-SZ, are the same within experimental error and fall within the target ellipses. The sample from the North Zone with a Pb concentration of 21 ppm is more radiogenic and plots well outside the target ellipses (Figs 9 and 10).

The two samples from the *Squim prospect* have widely differing lead contents and different Pb isotope ratios (Table 6; Figs 9 and 10). The sample representing sphalerite (+ galena mineralization) has higher $^{206}Pb/^{204}Pb$ ratios and plots outside the target. The chalcopyrite rich sample, S-1, with a Pb concentration of 47 ppm plots just within the target ellipse.

The single arsenopyrite-rich sample from the *Furry Creek prospect* has radiogenic Pb, similar to that of the high Pb sample from the Squim prospect.

The two samples from the *North Forks prospect*, NF-1 and NF-2 represenring chalcopyrite, pyrite and pyrrhotite mineralization in Triassic Chilliwack volcanics, are the same within experimental error, and represent the least radiogenic lead of all samples from the Britannia district (Table 6; Figs 9 and 10).

The combined data from prospects in the Mt Sicker area, southern Vancouver Island and the Britannia district, southwestern B.C. are plotted in Figures 11 and 12 with references to all four target ellipses.

6. DISCUSSION

1. *Sullivan* The results for Precambrian massive sulfide mineralization at Sullivan complement the limited database already available. The combined data form a homogeneous cluster which can be defined by a relatively small target ellipse.

2. *Vancouver Island* Target ellipses for Siluro-Devonian massive sulfide mineralization have been defined based on samples from the Lynx and HW mines of Westmin's Buttle Lake deposit. The ellipses are relatively large because of the few number of samples and the low-Pb content of some. Compared with Devonian SEDEX mineralization from the northern Canadian Cordillera. (e.g. Howard's Pass) the Buttle Lake data has similar $^{206}Pb/^{204}Pb$ but lower $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios. This relationship is consistent with a broadly similar age for the deposits but with derivation of Pb from different tectonic environments. Whereas the SEDEX deposits correlate more closely with Pb derived from a well-mixed crustal source, the Buttle Lake data indicate sources with lower U/Pb and Th/U ratios that may represent either crust subjected to granulite facies metamorphism or more directly mantle-derived rocks.

Three samples from the Mt Sicker prospects (3984, 85, 86) have similar isotopic compositions to the Buttle Lake signature and are considered to have a high probability of forming during a similar mineralizing event.

Sample number 3623, which is though to come from an horizon correlating with the Lenora-Tyee horizon, contains Pb with a similar isotopic composition to Sullivan Precambrian mineralization. Such a composition, together with samples 3982 3983 and 3987 and sample 3977 from Buttle Lake which have compositions intermediate between Precambrian and Palaeozoic mineralization, are difficult to explain in rocks of Siluro-Devonian age. The most obvious conclusion is that the mineralization represents Palaeozoic remobilization of Pb from relatively high-Pb Precambrian rocks. Other alternatives are that the Pb is a contaminant from the sample preparation procedure (from Pb-containing petrol or cross contamination with Sullivan samples), occurs in Precambrian rock fragments (?volcanic agglomerates or conglomerates) or that the host units or the samples themselves have been misidentified.

3. *Southwest British Columbia* The target deposits in this area, the Britannia and Northair mines, have similar isotopic compositions although there may be slight differences between them. The most startling feature of the results for these Cretaceous deposits is the similarity of the $^{206}Pb/^{204}Pb$ ratios with the Palaeozoic Buttle Lake mineralization. It would be reasonable to expect that Siluro-Devonian mineralization would have $^{206}Pb/^{204}Pb$ ratios about 3.6% lower than Cretaceous mineralization, together with slightly lower $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios, provided the deposits formed in a similar tectonic environment.

The Cretaceous mineralization broadly fits the models for the average global evolution of Pb. These models attempt to explain the variation through time of the Pb isotopic compositions of massive sulfide deposits from throughout the world (e.g the growth curve of Cumming and Richards, 1975 plotted on the accompanying figures, or the model of Stacey and Kramers, 1975). The mineralization is however depleted in $^{207}Pb/^{204}Pb$ relative to these growth curves, probably indicating a large component of mantle derived Pb (see Figure 5 of Zartman and Doe, 1981 for the expected differences between crustal and mantle derived Pb).

The Buttle Lake mineralization does not fit such average growth curves, having $^{206}Pb/^{204}Pb$ ratios considerably that are higher than would be predicted (i.e the Pb is more radiogenic). Rather, the data more closely approximate the regional model proposed by Godwin *et al.*,1982 for shale hosted mineralization from northern B.C., (such as Howard's Pass). Again, lower $^{207}Pb/^{204}Pb$ ratios indicate a significant component of mantle-derived Pb.

The conclusion to be drawn from these differences is that the Pb in the Mesozoic and Palaeozoic deposits was derived from source rocks with significantly different Pb isotopic ratios as well as different U/Pb and Th/Pb ratios. The possibility of suspect (allocthonous) terrains would be a mechanism for bringing together such isotopically divergent rocks.

The samples from the *Roy Showing*, *Maggie Mines*, and *Red Tusk* prospects all fall within the Cretaceous massive sulfide signature (as given by the Britannia/Northair target ellipses) and can be considered to represent similar styles of mineralization. The single low-Pb sample from Red Tusk (RT-NZ, 21 ppm Pb) contains more radiogenic Pb ($^{206}Pb/^{204}Pb$ is 1.2% higher) which could result from radiogenic addition of ^{206}Pb from the radioactive decay of 238U since the Cretaceous (the rock would need to contain between 2 and 3 ppm U to account for the 1.2%

difference) and as such, the sample can be considered as possibly having the same initial (Cretaceous) signature.

However, the two samples from the *Squim Prospect* both contain more radiogenic Pb than the target, despite having relatively high-Pb. The Squim mineralization is therefore considered to have a low probability of being closely related to Cretaceous M.S. styles. Its isotopic composition may be explained by the addition of radiogenic Pb to the typical Cretaceous Pb as a result of post-Cretaceous vein formation. Similar reasoning can be used to explain the radiogenic Pb content of the sample from the *Furry Creek Prospect*.

The two samples from the *North Forks Prospect* contain significantly less radiogenic Pb than the targets. This relationship is consistent with the Lower Triassic age of the enclosing volcanics. Triassic massive sulfide mineralization, within the same tectonic province as the Cretaceous mineralization, would be expected to have an isotopic composition similar to that of the North Forks Prospect. However, 2 samples are insufficient to indicate whether the Pb from the prospect is homogeneous, which would give more indication of the likelyhood of massive sulfide mineralization.

7. CONCLUSIONS

1. A preliminary target signature for Mesozoic massive sulfide mineralization in southern Vancouver Island can be defined. Some samples from Mt Sicker prospects (3984, 85, 86) fall within the target and can be considered to have formed during a similar mineralizing event to the Buttle Lake mineralization. Other, mostly low-Pb, samples contain variable proportions of less radiogenic Pb, probably indicating a

Precambrian Pb component. Such a relationship may be geological, possibly representing Palaeozoic remobilization from relatively high-Pb Precambrian rocks, or anthropogenic, resulting from contamination with Sullivan type Pb.

2. The Northair and Britannia mines have homogeneous isotopic compositions which can be used to define a target ellipse for Cretaceous massive sulfide mineralization in southwest British Columbia. The Roy Showing, Maggie Mines and Red Tusk prospects have isotopic compositions consistent with formation from a similar mineralizing event to the target. However, the Squim Prospect and Furry Creek Prospect have a low probability of being related to such massive sulfide mineralization and may represent later vein-style mineralization.

3. Based on the isotopic compositions of the Cretaceous massive sulfide mineralization we would calculate that Triassic massive sulfide mineralization derived from similar source rocks would have a composition similar to that of the North Forks Prospect.

4. The isotopic relationship between the massive sulfide occurrences on southern Vancouver Island and the Britannia area of southwestern B.C. indicate fundamental differences in the source rocks for the two areas, perhaps resulting from the accretion of allochthonous terrains.

5. A well constrained target signature for Sullivan-style massive sulfide mineralization has been defined.

8. FOLLOW UP

1. Some of the low-Pb samples from the Mt Sicker area should be check-analysed to determine any possible contamination. Such contamination could feasably have resulted from soaking in petrol

(do Canadian refineries use Sullivan Pb in the petrol or MVT Pb- or is all petrol Pb-free?) or from contamination during crushing. If there are any uncrushed portions of these samples we could easily do a check.

2. The Target ellipse from Buttle Lake could be further constrained if 2 or 3 more high -Pb samples were analysed. The size of the target ellipse precludes finer scale discrimination of likely prospective and non-prospective exploration samples.

3. Based on these Pb isotope results the North Forks prospect looks interesting as possible Triassic M.S. style mineralization. Analysis of 4 or 5 more samples would help confirm this by testing the homogeneity of the deposit.

9. REFERENCES

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TABLE 1. Brief description and lead concentration values of pulps from the Sullivan Mine, British Columbia.

Sample	Description	Pb Content
3617	Massive Pb-Zn ore	9.03%
3618	Py-chlorite-albite hangingwall alteration	73ppm
3619	Banded massive sulfides	12.45%
3620	Massive sphalerite	13.15%
3621	Tourmaline footwall alteration	1760ppm
3622	Banded sphalerite-galena	46.5 %

TABLE 2. Brief description and lead concentration values of pulps from Vancouver Island, British Columbia, submitted for lead isotope analyses by CFC.

Westmin's Buttle Lake operations, Myra Falls

Sample	Description	Pb Content
3976	Lynx Mine, fragmental pyrite sphalerite	0.92%
3977	Lynx Mine, pyrite in sericitized felsics	115ppm
3978	Lynx Mine, pyrite in felsic tuffs	495ppm
3979	Lynx Mine, banded felsic tuff	57ppm
3980	HW Mine, massive pyrite	250ppm
3981	HW Mine, massive ore	505ppm

Mt Sicker property, southern Vancouver Island

Sample	Description	Pb Content
3623	Mount Sicker, chert and pyrite	640ppm
3982	Heather property, pryite in sericite schist	20ppm
3983	Tom Shaft Mt Sicker, massive pyrite	19ppm
3984	Lenora-Tyee, barite ore	1.62%
3985	Lenora-Tyee, quartz ore	124ppm
3986	Lenora-Tyee, carbonate ore	1.98%
3987	Mount Sicker, felsic tuff	7ppm

TABLE 3. Brief description and lead concentration values of pulps from the Britannia District, southwestern British Columbia, submitted for lead isotope analyses by CFC.

Sample	Description	Pb Content
Britannia		
B-1	Cpy stringer in chloritized volcanics	38ppm
B-2	Massive chert	360ppm
B-3	Banded sph/gn/py/cpy and recrystallized chert	600ppm
B-4	Baritic, zinc-rich MS	6000ppm
Northair Mine		
NA-1	Gn/py, minor sph/cpy with calcite gangue and chloritized wall-rock fragments	44.0 %
NA-2	Same as NA-1 but less mineralized	2.64%
Roy Showing		
R-1	Roy prospect cpy - stringer mineralization	790ppm
R-2	Cpy - stringers in Roy Rhyolite	182ppm
R-3	Sph mineralization (diss) in Roy Rhyolite	305ppm
R-4	No sample description	68ppm
Red Tusk Prospect		
RT-MZ	Main zone	192ppm
RT-NZ	North zone	21ppm
RT-SZ	South zone	5000ppm
Squim Prospect		
S-1	Cpy rich MS	47ppm
S-2	Galena, sphalerite	29.4 %
Furry Creek		
G-59	Arsenopy in silicified ash "McColl Prospect"	1140ppm
Maggie Mines		
M2	Coarse sph in quartz vein breccia	152ppm
M1	Similar to M2 but finer grained + more quartz	66ppm
North Forks Prospect		
NF-1	Equigranular massive pyrrhotite/chalcopyrite	62ppm
NF-2	Banded chalcopyrite, pyrrhotite and pyrite	72ppm

TABLE 4. Lead isotope data from the Sullivan Mine, B.C.

ample	208 Pb / 206 Pb	207 Pb / 206 Pb	206 Pb / 204 Pb	207 Pb / 204 Pb	208 Pb / 204 Pb	Pb(ppm)
LLIVAN - CFC						
. 3617	2.1842	0.9357	16.499	15.439	36.037	90,300
. 3618 A	2.1695	0.9127	16.938	15.459	36.746	73
. 3618 B	2.1686	0.9117	16.973	15.475	36.807	73
. 3619	2.1851	0.9361	16.488	15.433	36.026	124,500
. 3620	2.1859	0.9359	16.514	15.455	36.096	131,500
. 3621	2.1909	0.9370	16.482	15.443	36.111	1,760
. 3622	2.1841	0.9357	16.500	15.439	36.038	465,000
LIVAN CSIRO DATA						
356	2.1834	0.9354	16.491	15.426	36.006	
357	2.1854	0.9358	16.504	15.444	36.068	
358	2.1849	0.9358	16.500	15.441	36.051	
359	2.1867	0.9363	16.502	15.451	36.085	
360	2.1854	0.9360	16.497	15.441	36.053	

B refer to repeat dissolutions of the same sample.
mple number prefixes refer to plotted points

TABLE 5. Lead isotope data of samples from Vancouver Island.

ample	208 Pb / 206 Pb	207 Pb / 206 Pb	206 Pb / 204 Pb	207 Pb / 204 Pb	208 Pb / 204 Pb	Pb(ppm)
UTTLE LAKE - LYNX AND HW MINES						
. 3976	2.0557	0.8396	18.515	15.545	38.061	9,200
. 3977	2.1495	0.9103	17.007	15.480	36.556	115
. 3978	2.0663	0.8462	18.400	15.570	38.020	495
. 3979	2.0652	0.8472	18.375	15.568	37.949	57
. 3980	2.0591	0.8425	18.470	15.561	38.032	250
. 3981	2.0546	0.8402	18.507	15.549	38.025	505
T SICKER PROSPECTS						
. 3623	2.1807	0.9328	16.555	15.442	36.101	640
. 3982 A	2.1044	0.8742	17.752	15.519	37.359	20
. 3982 B	2.1035	0.8737	17.749	15.507	37.335	20
. 3983	2.1082	0.8783	17.681	15.530	37.274	19
. 3984	2.0587	0.8395	18.516	15.543	38.117	16,200
. 3985	2.0602	0.8403	18.523	15.566	38.161	124
. 3986	2.0594	0.8397	18.518	15.550	38.137	19,800
. 3987	2.0680	0.8491	18.294	15.533	37.832	7

B refer to repeats on separate sample dissolutions
mple number prefixes refer to plotted points

ABLE 6. Lead isotope data of samples from the Britannia District.

mple	208 Pb / 206 Pb	207 Pb / 206 Pb	206 Pb / 204 Pb	207 Pb / 204 Pb	208 Pb / 204 Pb	*Pb(ppm)
ITANNIA MINE						
. B-1 A	2.0599	0.8432	18.396	15.511	37.893	38
B-1 B	2.0603	0.8431	18.413	15.524	37.937	38
B-2	2.0545	0.8403	18.456	15.509	37.918	360
B-3 A	2.0548	0.8402	18.467	15.515	37.945	600
B-3 B	2.0544	0.8400	18.469	15.513	37.943	600
B-4	2.0542	0.8399	18.469	15.512	37.938	6,000
THAIR MINE						
NA-1	2.0614	0.8434	18.411	15.528	37.954	440,000
NA-2 A	2.0608	0.8432	18.415	15.526	37.950	26,400
NA-2 B	2.0612	0.8433	18.409	15.524	37.945	26,400
Y SHOWING						
. R-1	2.0599	0.8429	18.404	15.513	37.911	790
. R-2	2.0593	0.8428	18.405	15.511	37.901	182
. R-3	2.0604	0.8434	18.398	15.518	37.908	305
. R-4	2.0533	0.8394	18.488	15.518	37.963	68
GIE MINES						
. M-2 A	2.0569	0.8414	18.446	15.521	37.942	152
. M-2 B	2.0570	0.8414	18.447	15.522	37.945	152
. M-1	2.0568	0.8413	18.440	15.514	37.927	66
2 TUSK PROSPECT						
. RT-MZ	2.0550	0.8409	18.432	15.500	37.878	192
. RT-NZ	2.0359	0.8327	18.638	15.519	37.945	21
. RT-SZ A	2.0560	0.8412	18.436	15.508	37.903	5,000
RT-SZ B	2.0576	0.8416	18.442	15.521	37.946	5,000
IM PROSPECT						
S-1 A	2.0540	0.8396	18.483	15.518	37.965	47
S-1 B	2.0548	0.8398	18.487	15.525	37.987	47
S-2 A	2.0476	0.8344	18.610	15.529	38.106	294,000
S-2 B	2.0485	0.8348	18.603	15.529	38.108	294,000
CREEK PROSPECT						
G-59	2.0471	0.8344	18.599	15.520	38.075	1,140
H FORKS PROSPECT						
NF-1	2.0721	0.8517	18.201	15.502	37.714	62
NF-2 A	2.0705	0.8517	18.176	15.480	37.634	72
NF-2 B	2.0725	0.8521	18.194	15.503	37.707	72

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le number prefixes refer to plotted points

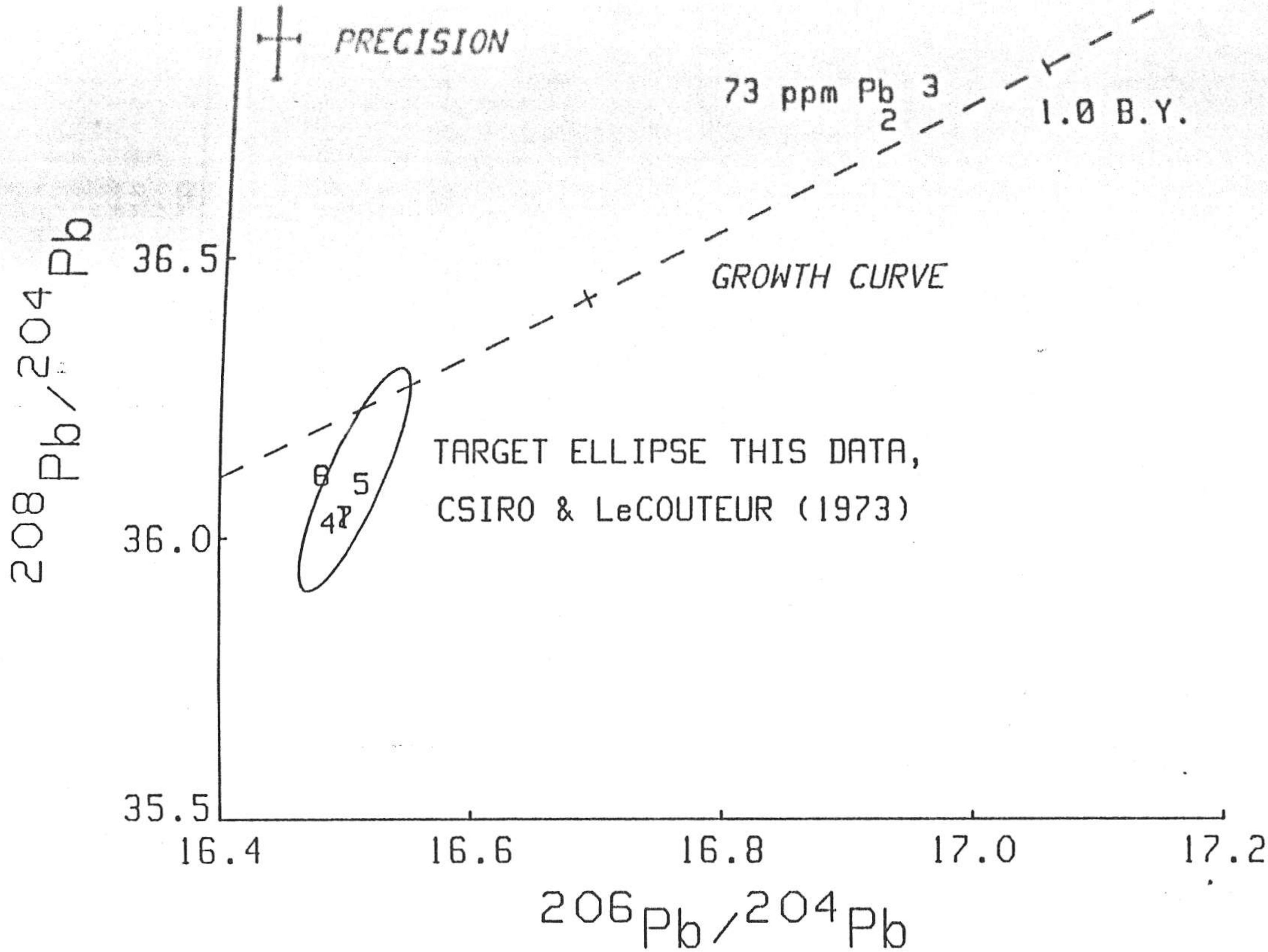

Figure 1. A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing results of analyses of Sullivan samples in comparison to Sullivan target ellipse defined by all SIROTOPE data. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 4).

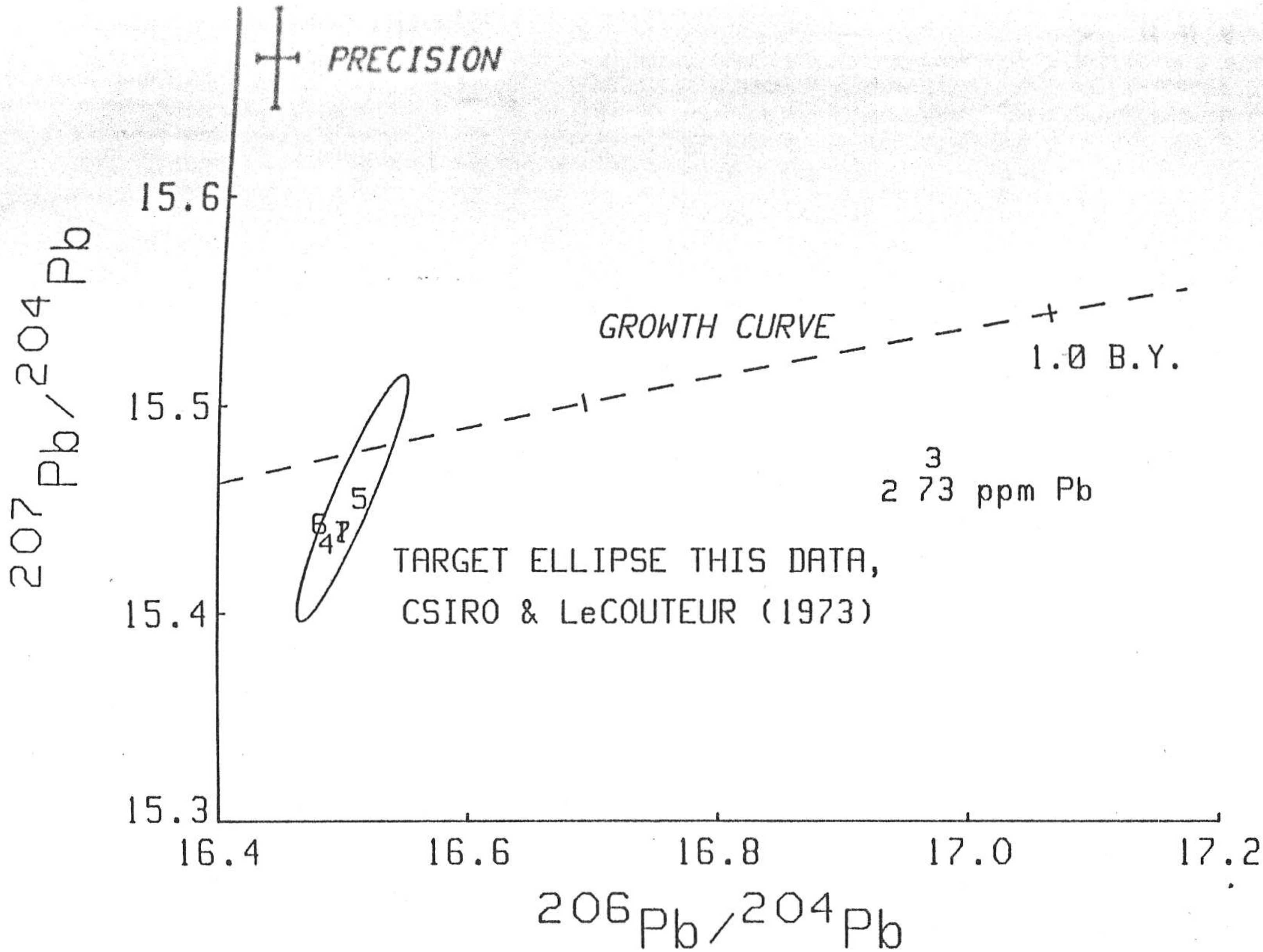

Figure 2. A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing results of analyses of Sullivan samples in comparison to Sullivan target ellipse defined by all SIROTOPE data. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 4).

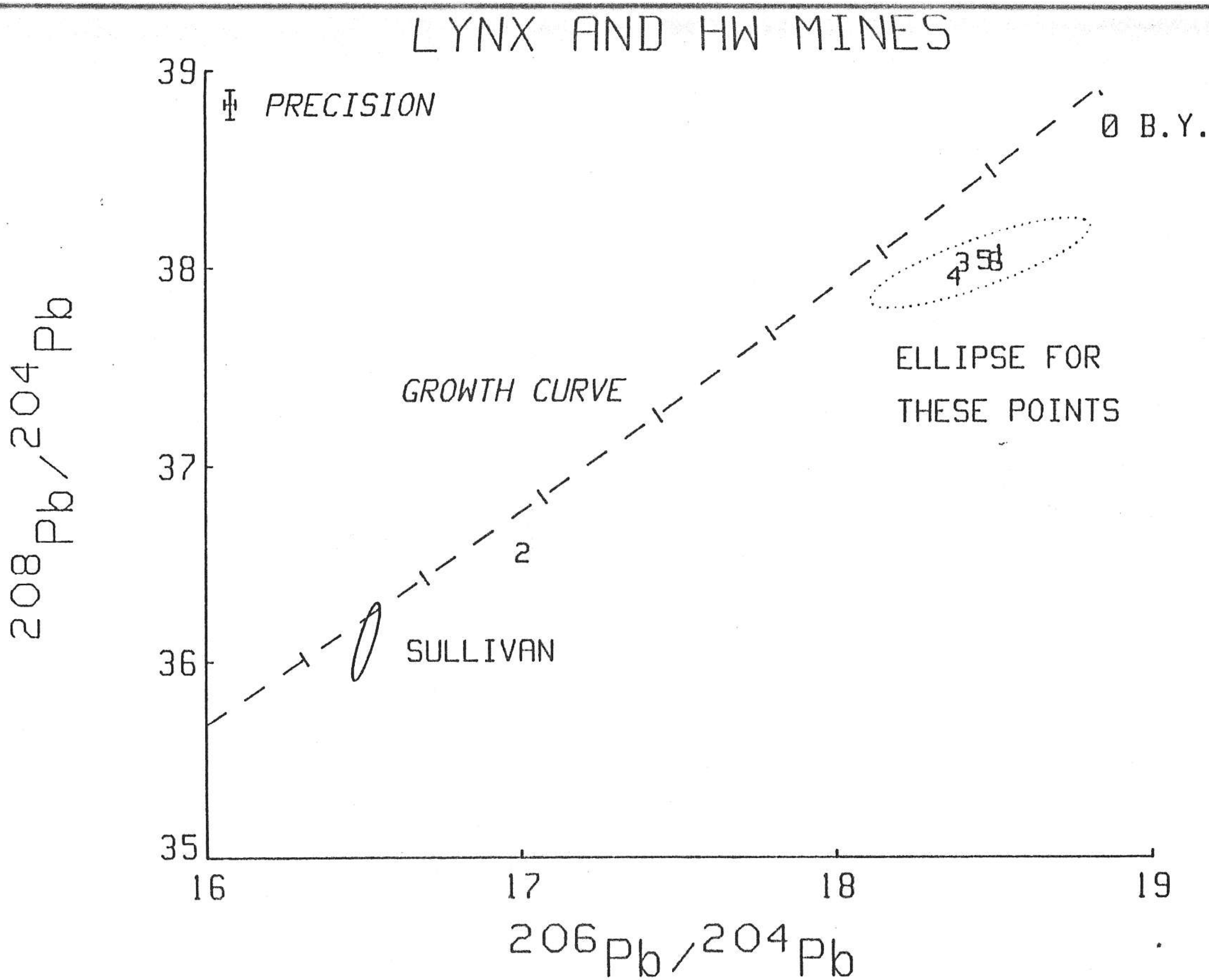

Figure 3. A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing the Buttle Lake mines data and the the Buttle lake and Sullivan Target ellipses. Note the size of the Buttle Lake ellipse in comparison to the data that define it. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 5).

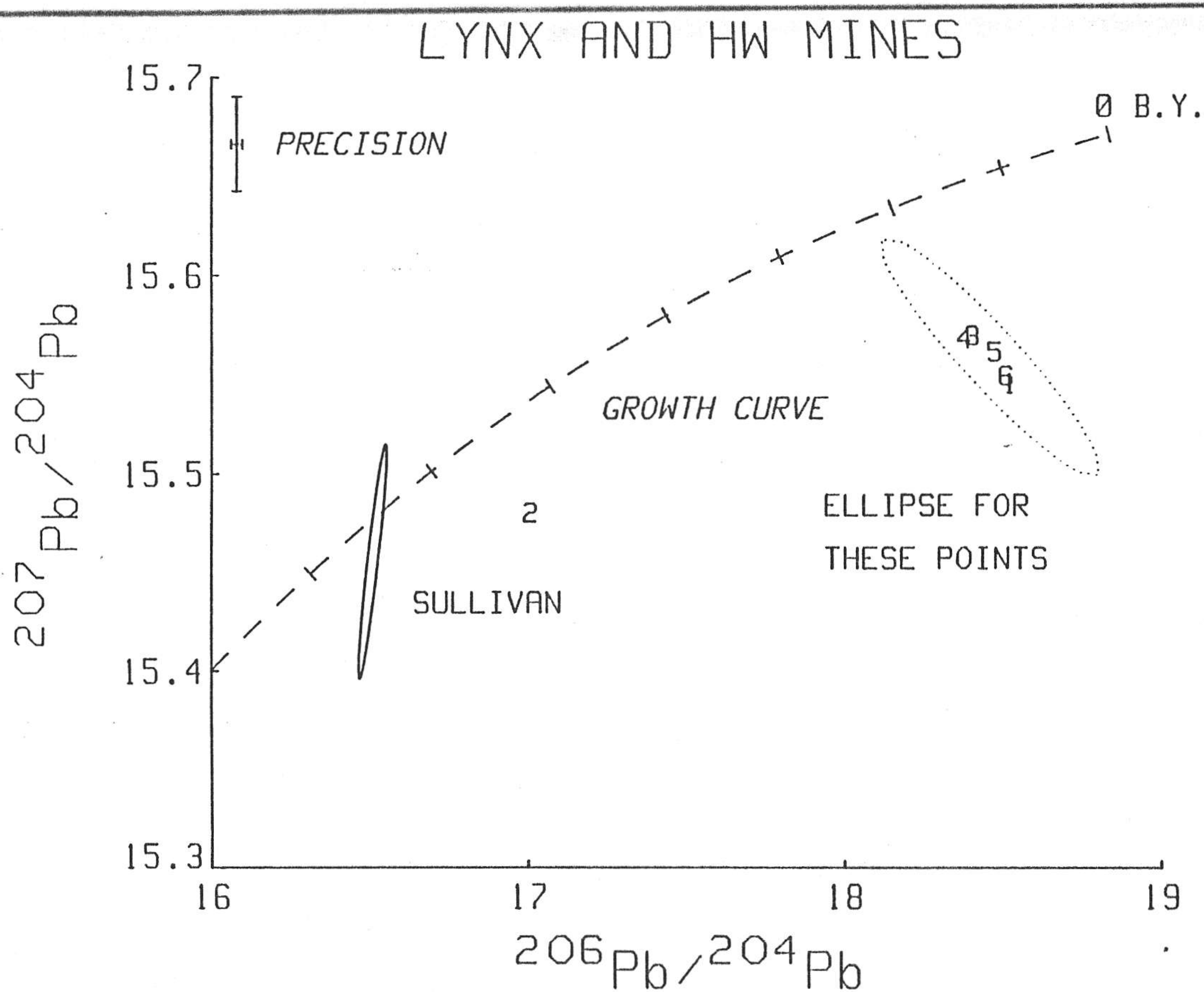

Figure 4. A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing the Buttle Lake mines data and the the Buttle lake and Sullivan Target ellipses. Note the size of the Buttle Lake ellipse in comparison to the data that define it. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 5).

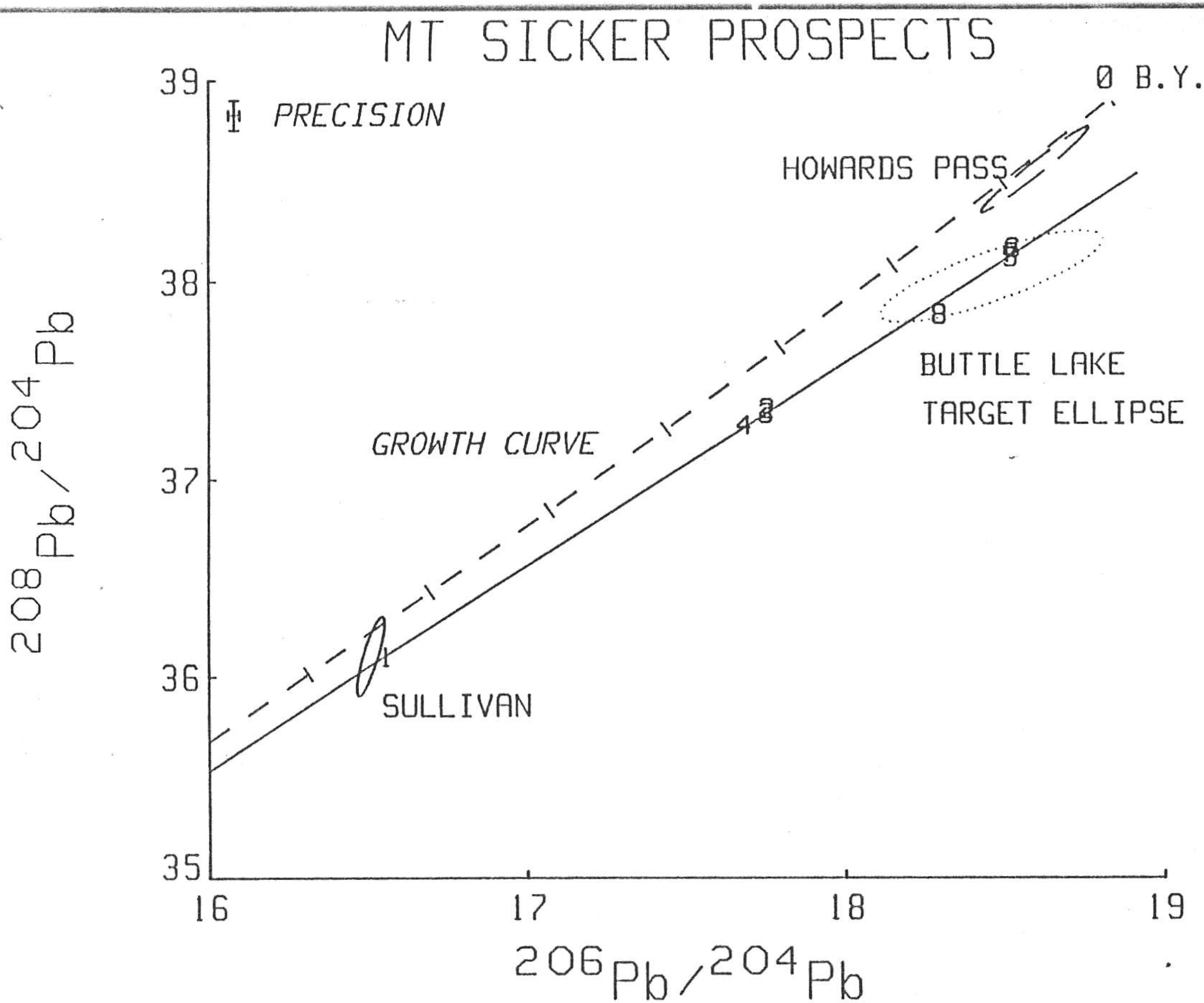

Figure 5. A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing Mt Sicker prospects data in comparison with target ellipses for Sullivan, Buttle lake and Howard's Pass. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 5).

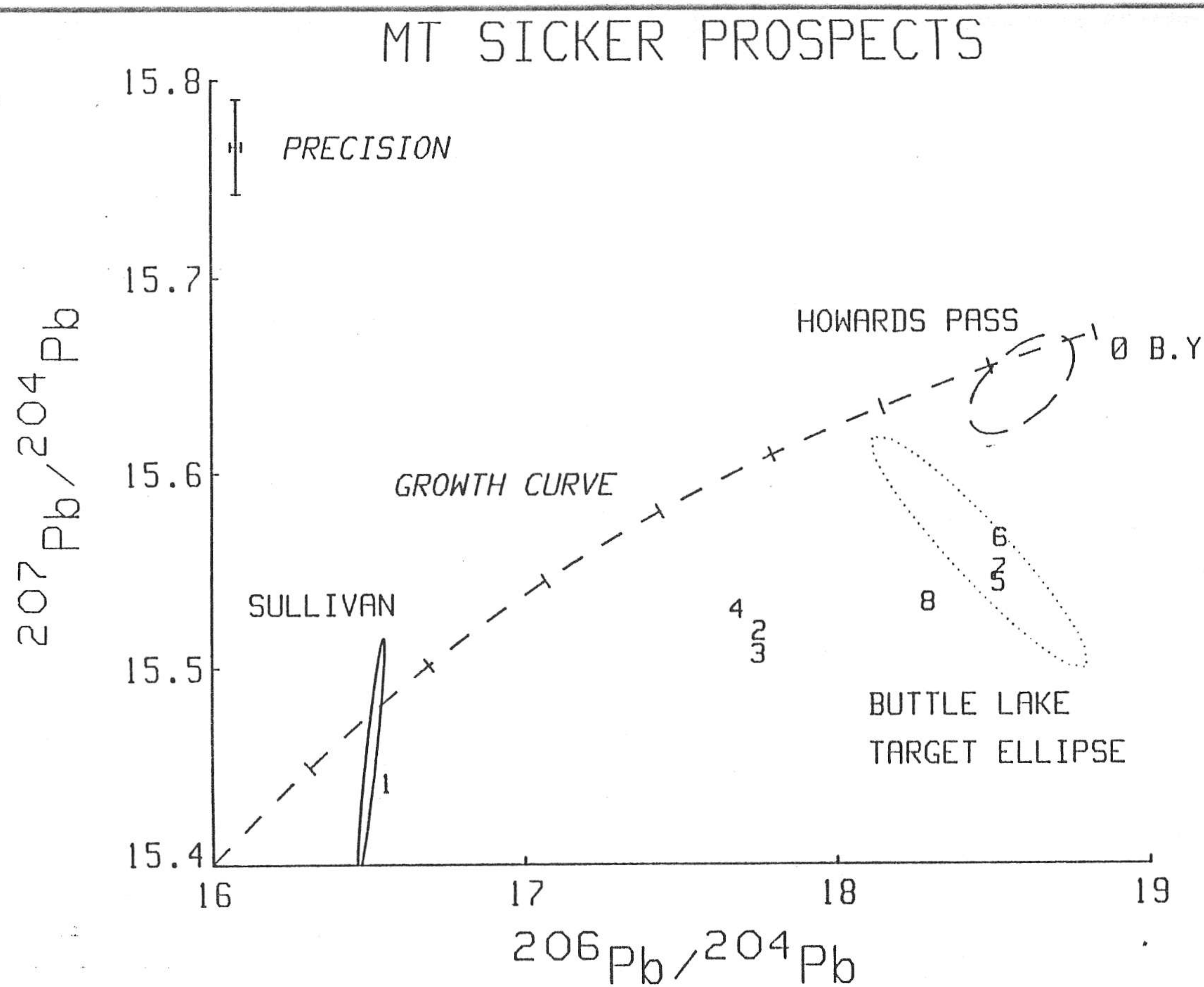

Figure 6. A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing Mt Sicker prospects data in comparison with target ellipses for Sullivan, Buttle lake and Howard's Pass. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 5).

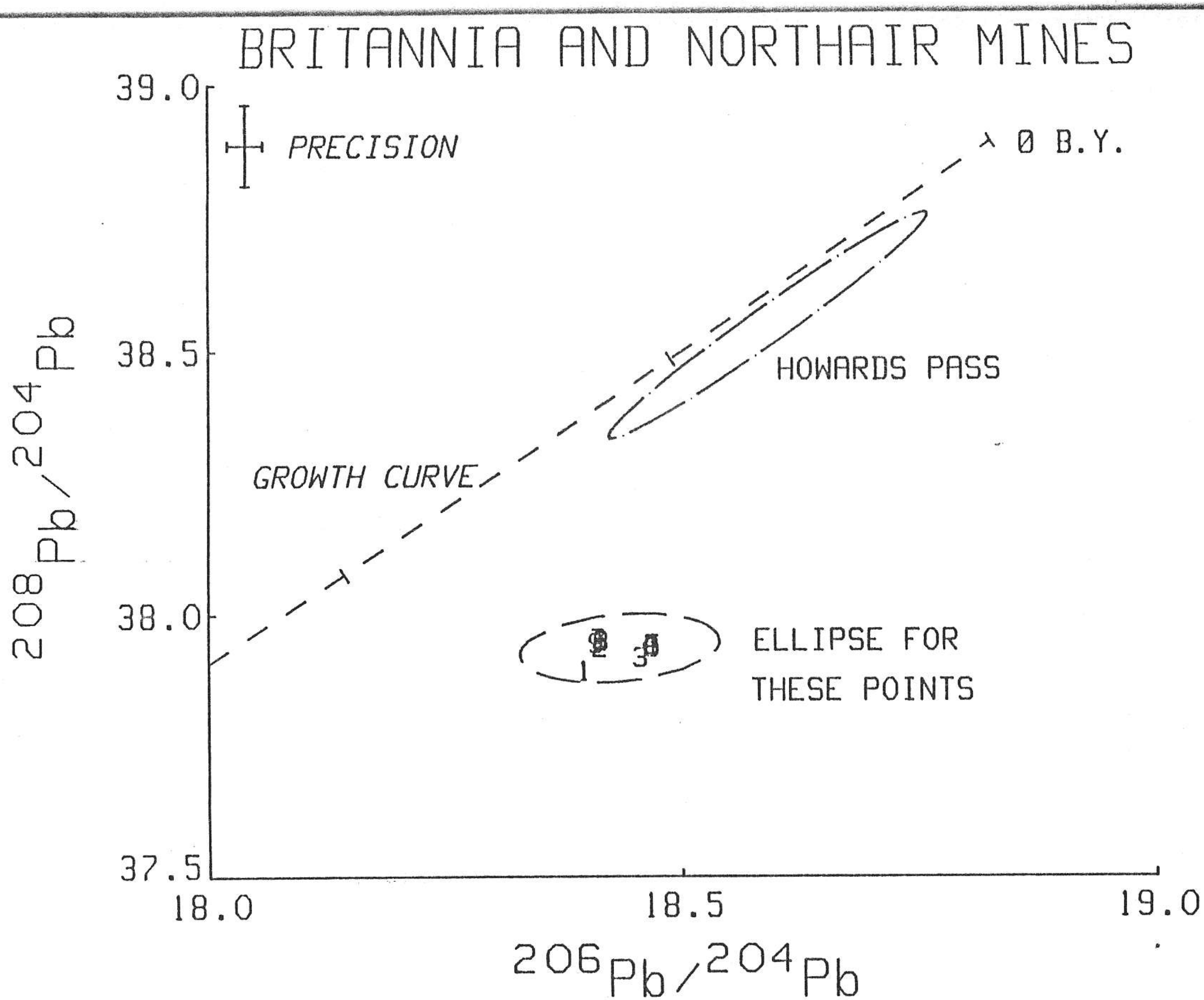

Figure 7. A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing Britannia and Northair Mine data and the target ellipse defined by that data. The Howard's Pass target ellipse is shown for comparison. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 6).

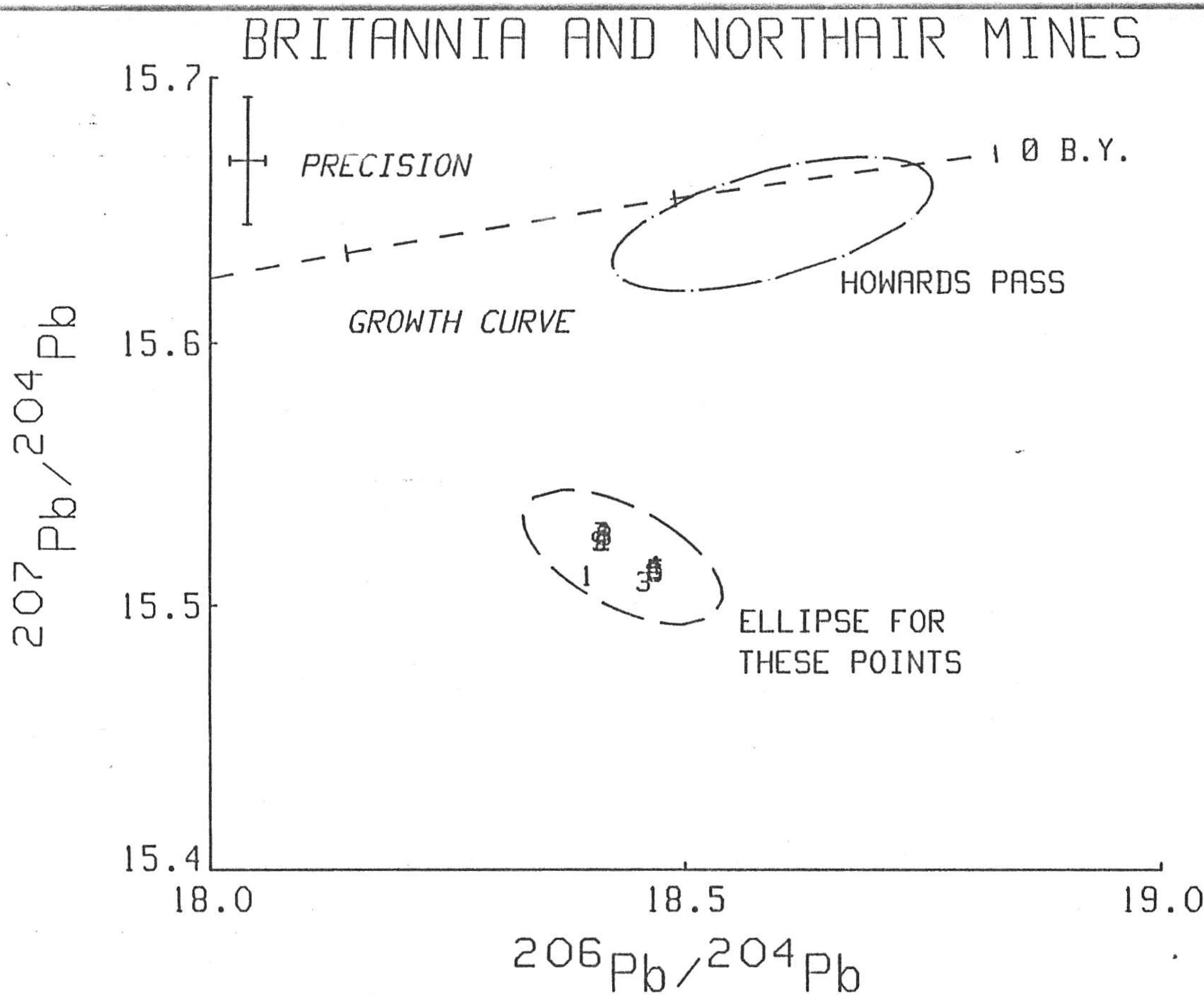

Figure 8. A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing Britannia and Northair Mine data and the target ellipse defined by that data. The Howard's Pass target ellipse is shown for comparison. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 6).

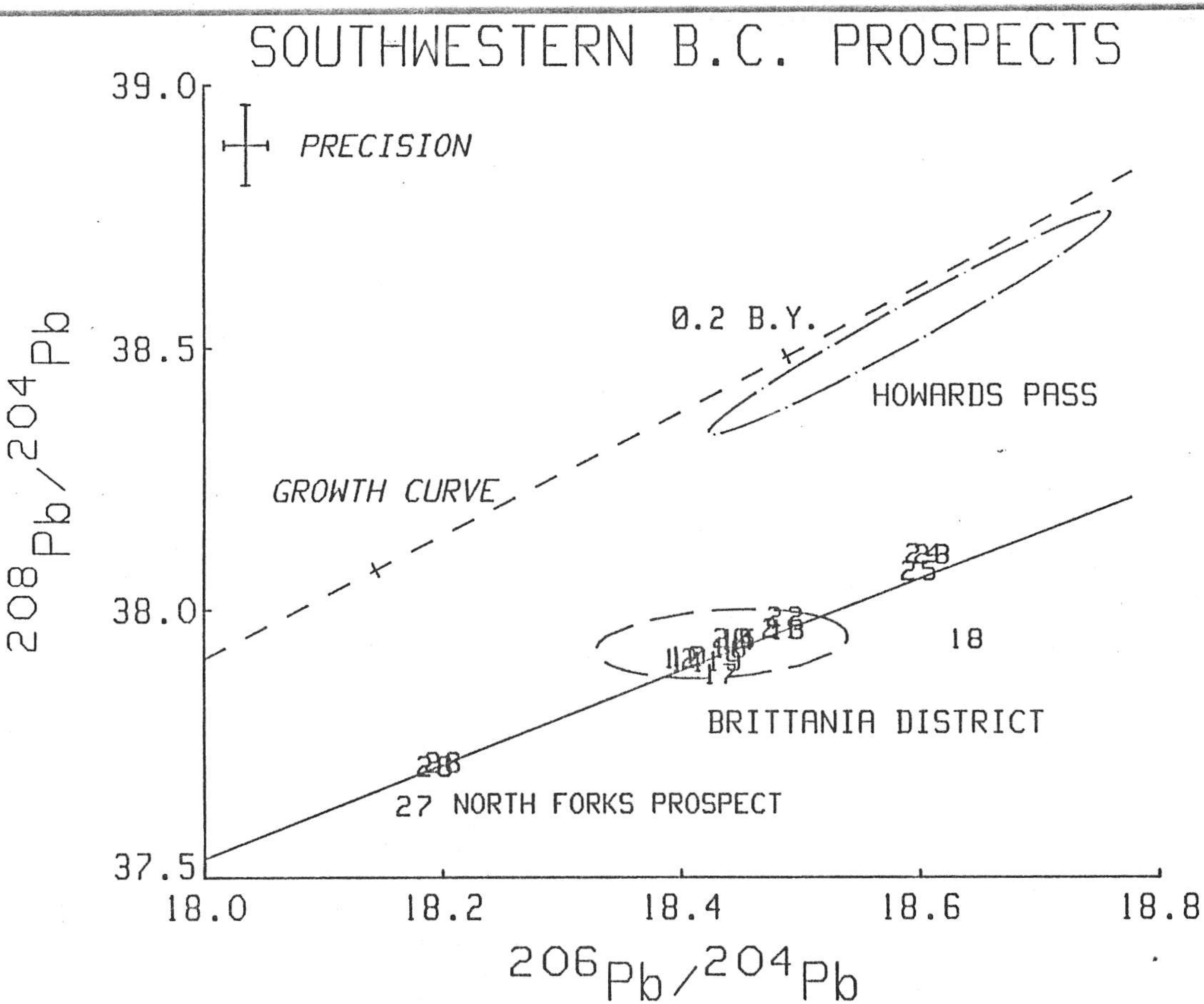

Figure 9. A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing the southwest British Columbia prospects data and target ellipses for Britannia/Northair and Howard's Pass. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 6).

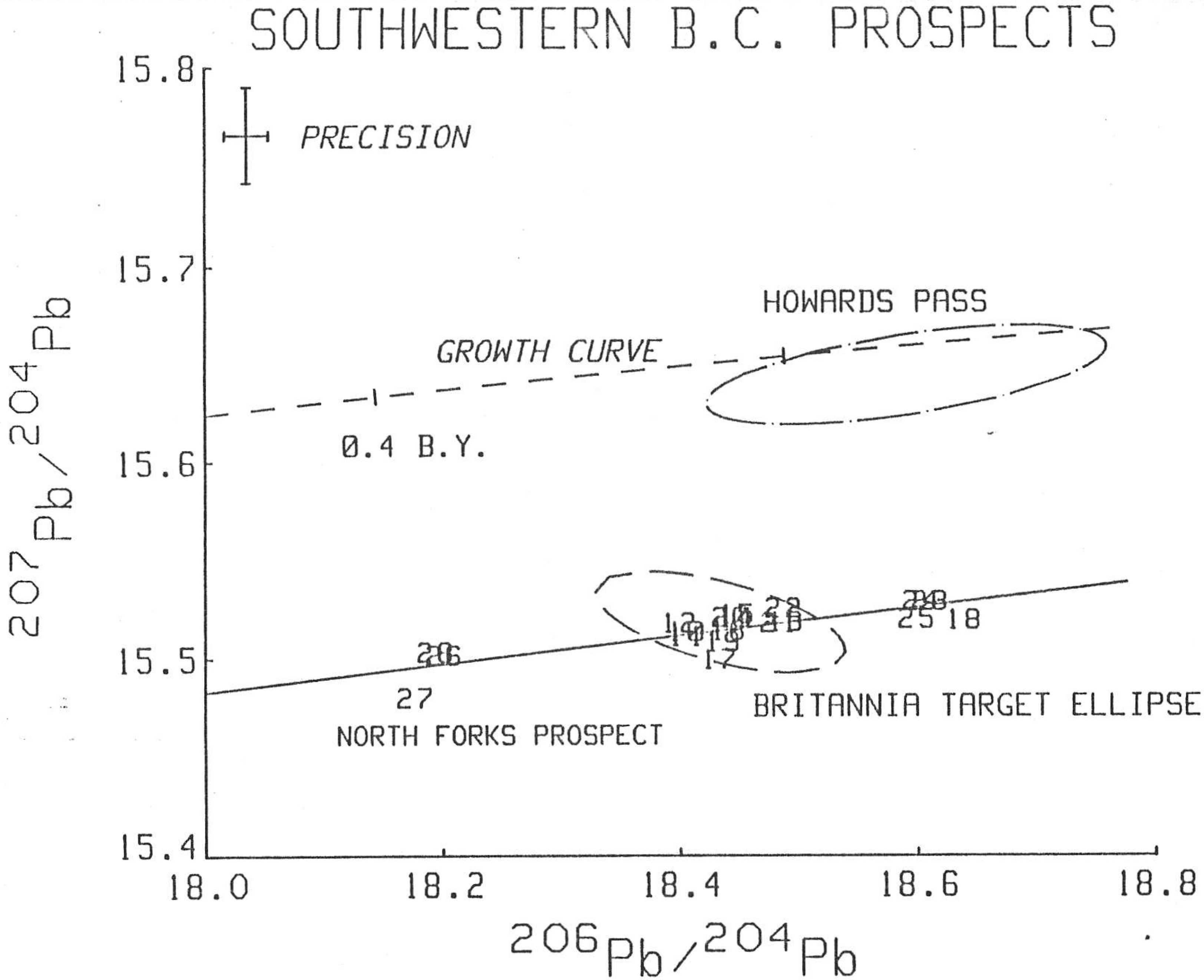

Figure 10 A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram showing the southwest British Columbia prospects data and target ellipses for Britannia/Northair and Howard's Pass. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My (Sample numbers - Table 6).

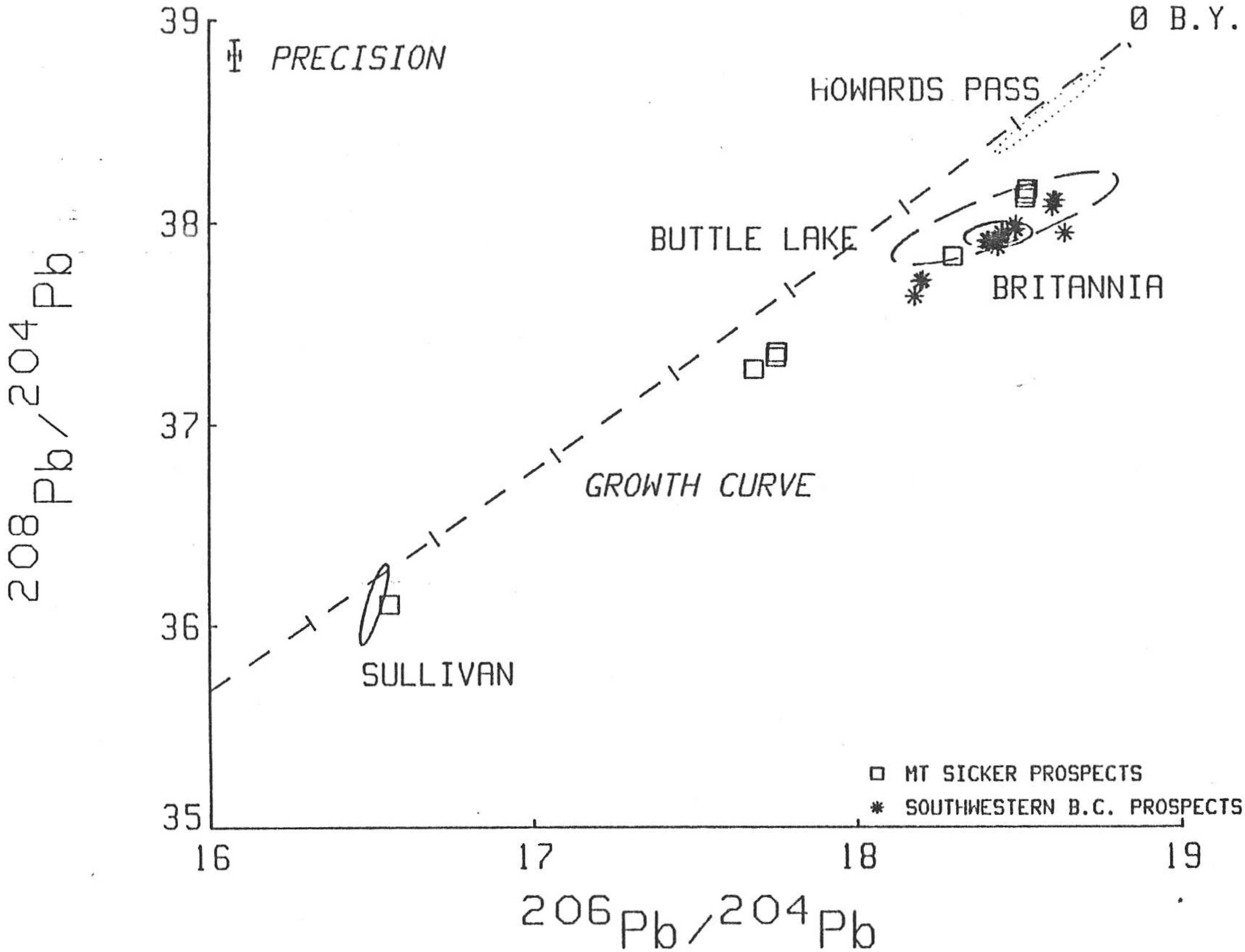

Figure 11 A $^{208}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram comparing data from the Mt Sicker prospects and Southwest British Columbia prospects with target ellipses for Sullivan, Buttle Lake, Howard's Pass and Britannia/Northair. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My.

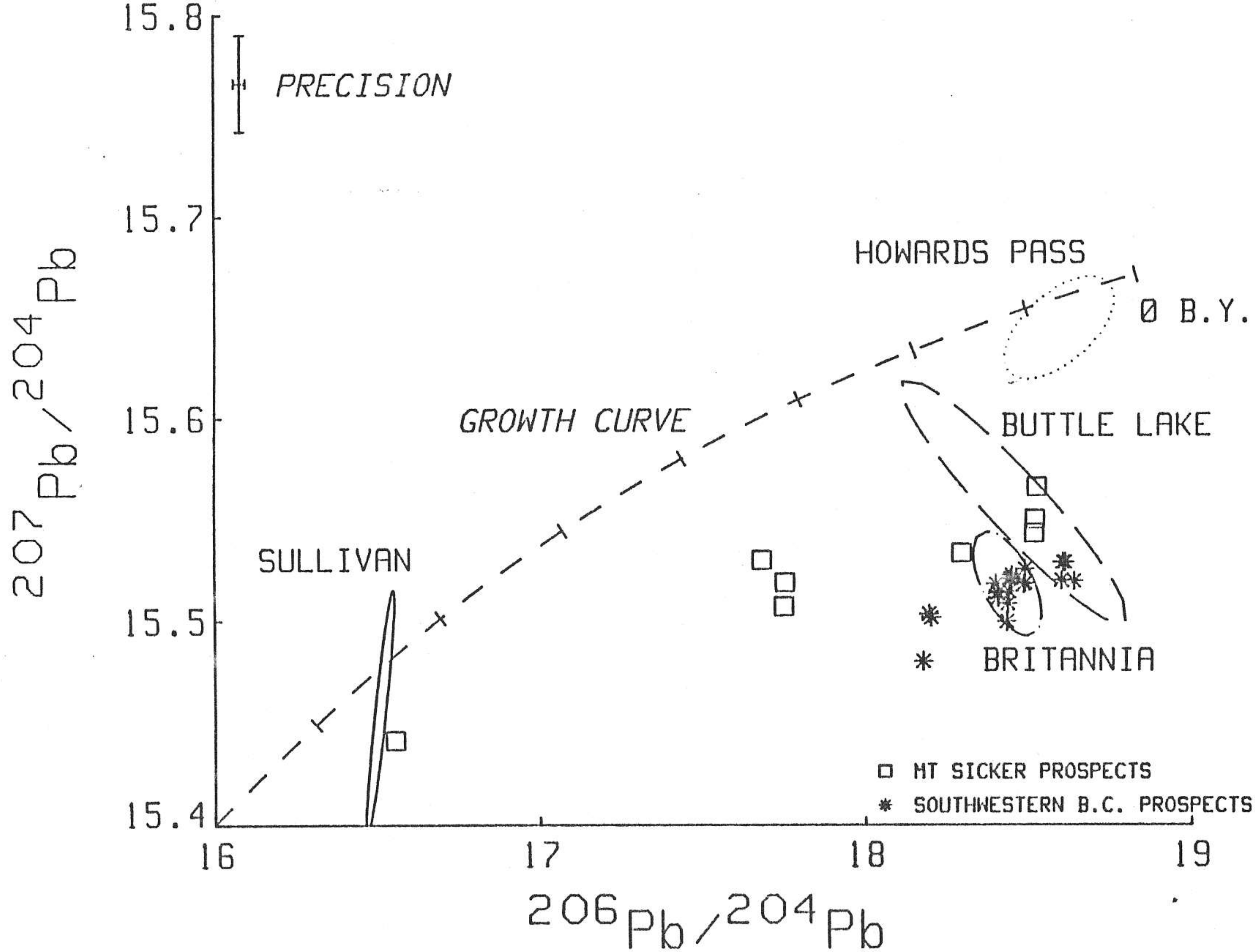

Figure 12 A $^{207}Pb/^{204}Pb$ vs $^{206}Pb/^{204}Pb$ diagram comparing data from the Mt Sicker prospects and Southwest British Columbia prospects with target ellipses for Sullivan, Buttle Lake, Howard's Pass and Britannia/Northair. Growth curve of Cumming and Richards (1975) is marked in increments of 200 My.

MINNOVA

Minnova Inc.
Mining Innovation
4th Floor
311 Water Street
Vancouver, British Columbia
V6B 1B8
Telephone (604) 681-3771
Telecopier (604) 681-3360

18 April 1988

Science Council of British Columbia
100 - 3700 Gilmore Avenue
Burnaby, BC
V5G 4M3

Dear Sirs:

RE: Support of Research on Lead Isotopes Directed by C.I. Godwin, U.B.C. (Application entitled "Optimization of Exploration Decisions by Application of Galena Lead Isotope Data in British Columbia.")

MINNOVA has a major commitment to two areas actively under investigation by the Godwin lead isotope research group; namely the Britannia - Harrison Lake Area in southwestern B.C.. and the Adams Plateau area in south-central B.C. We have provided field support for MSc candidate D. Reddy in the Indian River area immediately north of Britannia, and he is analysing galenas regionally in southwestern B.C. as part of his thesis. F. Goutier, who completed a MSc thesis on the Adams Plateau area on lead isotopes, is currently working for MINNOVA. Briefly, we are very interested in this research - several years ago we had half a dozen analyses done commercially in Australia to help guide our exploration.

As a contribution to the research of the Godwin group and in addition to the student field support already provided, we will involve our geologists in some consultative work in the two areas where we have mutual interests. We can also provide about 35 samples of galena from showings that we have investigated, but would be very costly to resample.

Yours truly,

A.J. Davidson
Exploration Manager
Western Canada

AJD/kgf