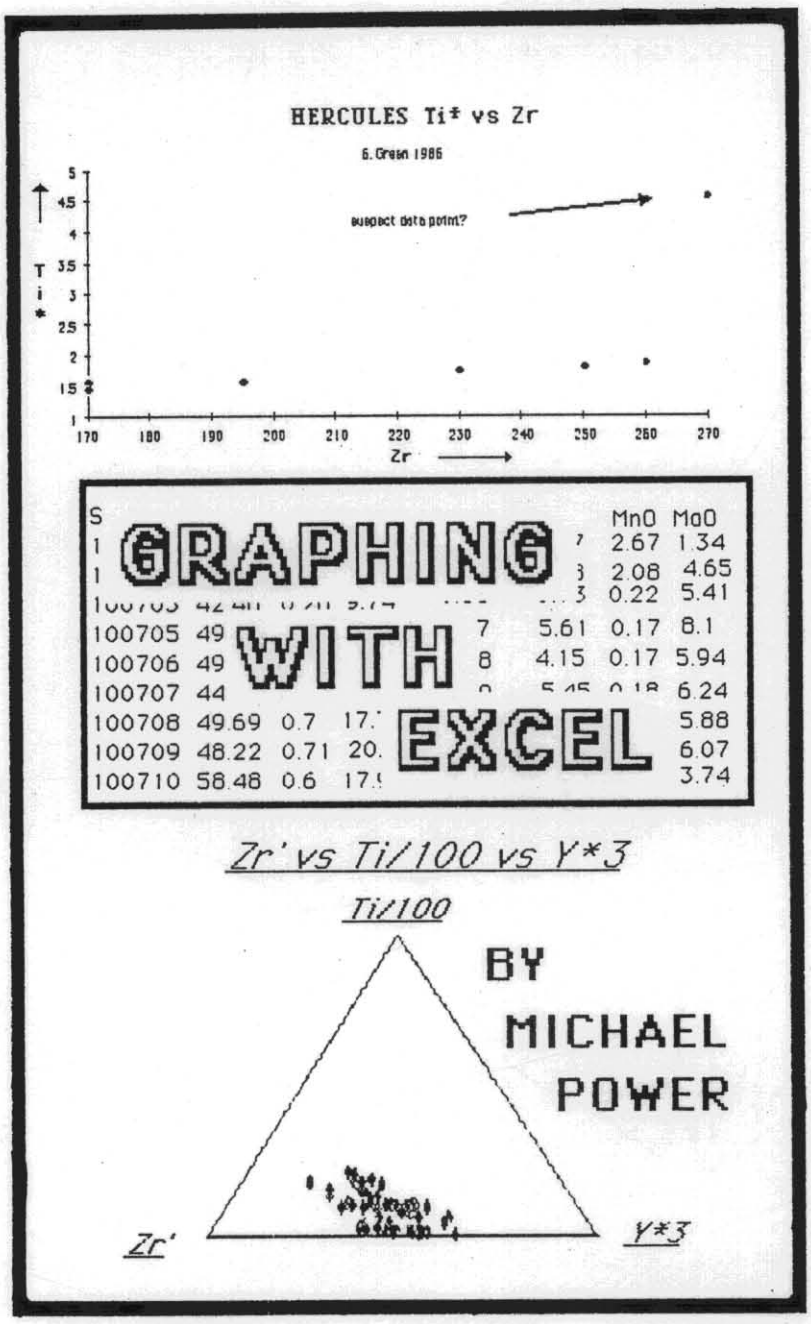
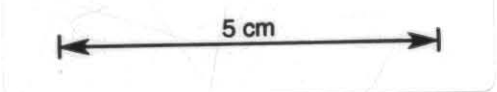
UR1987_04

UNPUBLISHED REPORT 1987/04





1987/04. Graphing with Excel.

M. Power

ABSTRACT

This instruction manual teaches the user how to use the "Apple Macintosh" personal computer to plot 'X-Y' and 'triangular' graphs. The Apple uses the program "Excel" to store and manipulate data, and it is mainly this program that this manual is concerned with. It is assumed that the data to be plotted already exists in the computer as an "Excel" worksheet, and that the user is familiar with basic "Mac" operations.

INTRODUCTION

This set of instructions aims to teach the user, by example, how to use the "Apple Macintosh" to draw X-Y and triangular graphs. I have assumed that the User is familiar with the basic operations on the "Mac" such as 'clicking', 'dragging', basic editing and so on.

The graphing is mainly conducted using the program *"Excel"*, but the program *"Full paint"* is used when plotting triangular graphs.

Even though this manual appears to be quite lengthy, it is for the most part taken up with "screen dumps", showing what the screen looks like at any particular moment. It is anticipated that this feature will make the manual fairly easy to use. I have deliberately made the instructions for triangular graphing briefer than those of X-Y graphing to avoid needless repetition. As such, I would expect people to master the techniques involved with X-Y plots before tackling their triangular counterparts.

Finally I would like to acknowledge the help of Ralph Bottrill who initially taught me the bulk of this information, and who developed this triangular graphing method for the "Mac" in the first place.

GRAPHING WITH EXCEL

Open Excel (assuming your disc holds an Excel file)

- insert 'Excel- main' disc.
- insert personal data disc.
- 'double click' on personal data disc symbol to open it.
- 'double click' on Excel file to be graphed.
  eg. 'Mick chem data'. (diag 1)
  Excel data matrix will appear on the screen.

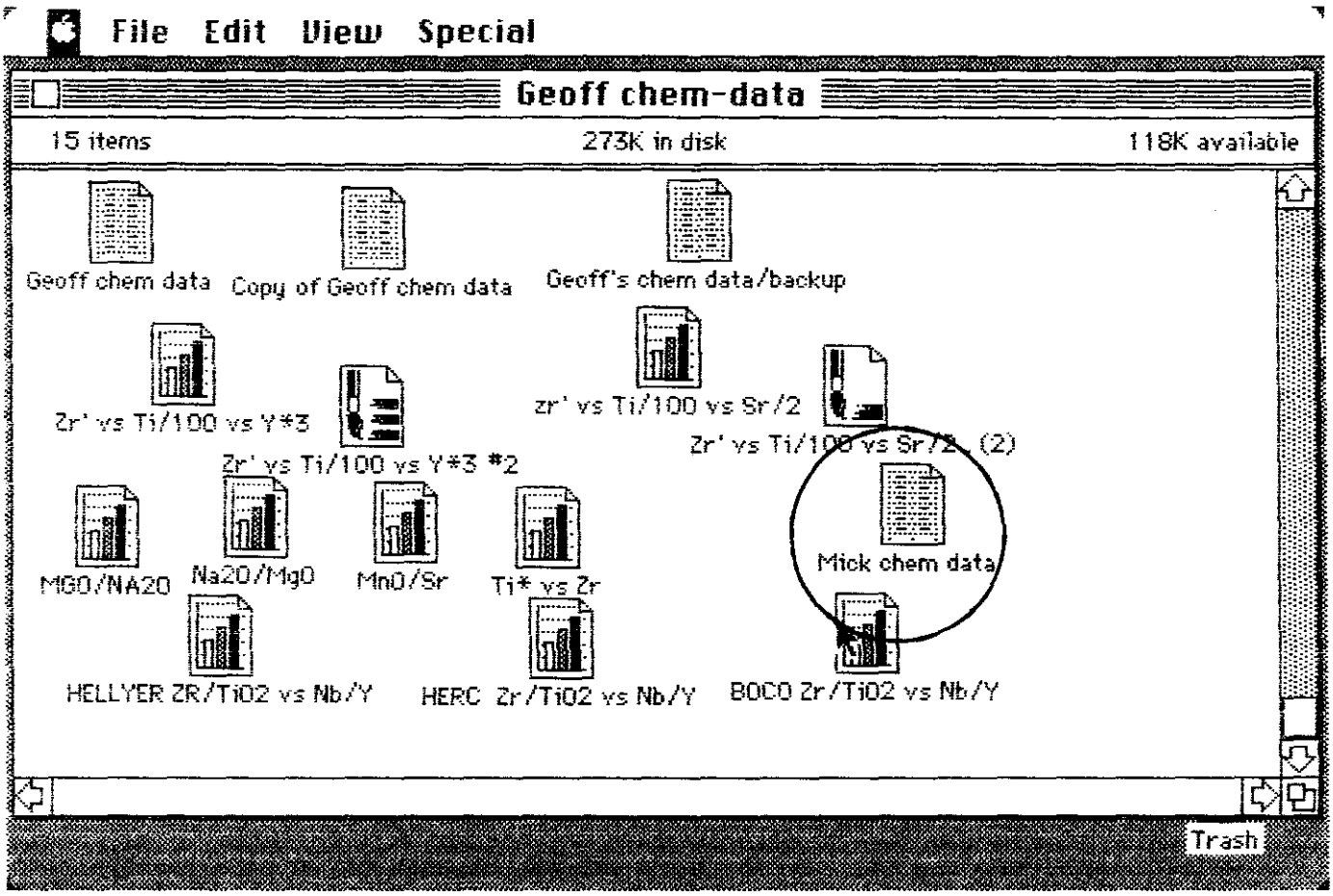

File Edit View Special
Geoff chem-data
15 items
273K in disk
118K available
Geoff chem data
Copy of Geoff chem data
Geoff's chem data/backup
Zr' vs Ti/100 vs Y*3
Zr' vs Ti/100 vs Y*3 #2
zr' vs Ti/100 vs Sr/2
Zr' vs Ti/100 vs Sr/2 (2)
MGO/NA2O
Na2O/MgO
MnO/Sr
Ti* vs Zr
Mick chem data
HELLYER ZR/TiO2 vs Nb/Y
HERC Zr/TiO2 vs Nb/Y
BOCO Zr/TiO2 vs Nb/Y
Trash

Diagram 1.

1) X-Y PLOTS :

Eg. Graph of Ti* vs Zr

where

$$Ti^* = TiO_2 \times 47.9/79.9 \times 100$$

Create a new column

- A new column must be created in the Excel table to hold the values of Ti*. The first free column to the right of the Excel table is utilised for this purpose.
- Make the leading empty cell of this column 'active' by 'clicking' on it. (diag 2)
- Type in this column's name. (eg. Ti*)
- 'Click' on cell below. (diag 3)
- Move left column margin to the right to give room for other columns.
  ie. move pointer onto the black vertical line at the bottom of the table and 'click and drag' it to the right. (diag 3)
- This allows two seperate portions of the table to be independently controlled.
- Adjust the columns so that TiO_2 is on the L.H.S. and Ti* is on the R.H.S. (diag 4)

File Edit Formula Format Data Options Macro Window

AL1

Mick chem data

	A	AF	AG	AH	AI	AJ	AK	AL	A
1	Sample No	Zn	Zr	Del 18 O	Del 13 C	Del 34 S	Zn No.		
2	100701	115	125				85.821		
3	100702	53	120				100		
4	100703	43	75				####		
5	100705	70	150				####		
6	100706	47	140				####		
7	100707	78	140				####		
8	100708	159	105				94.643		
9	100709	257	185				92.78		
10	100710	140	170				93.96		
11	100711	140	135				97.222		
12	100712	156	115				86.667		
13	100713	71	84				80.682		
14	100714	115	96				####		
15	100715	59	160				76.623		
16	100716	45	145				70.313		
17	100717	240	120				53.333		
18	100718	160	78				65.844		
19	100719	124	62				91.852		

Diagram 2.

File Edit Formula Format Data Options Macro Window

AL2

Mick chem data

	A	AF	AG	AH	AI	AJ	AK	AL	A
1	Sample No	Zn	Zr	Del 18 O	Del 13 C	Del 34 S	Zn No.	Ti*	
2	100701	115	125				85.821		
3	100702	53	120				100		
4	100703	43	75				####		
5	100705	70	150				####		
6	100706	47	140				####		
7	100707	78	140				####		
8	100708	159	105				94.643		
9	100709	257	185				92.78		
10	100710	140	170				93.96		
11	100711	140	135				97.222		
12	100712	156	115				86.667		
13	100713	71	84				80.682		
14	100714	115	96				####		
15	100715	59	160				76.623		
16	100716	45	145				70.313		
17	100717	240	120				53.333		
18	100718	160	78				65.844		

'Drag' this bar to the right to widen the left margin.

Diagram 3.

Mick chem data

	B	C	AH	AI	AJ	AK	AL	AM	A
1	SiO2	TiO2	Del 18 O	Del 13 C	Del 34 S	Zn No.	Ti*		
2	67.82	0.61				85.821			
3	73.62	0.36				100			
4	42.48	0.28				####			
5	49.09	0.58				####			
6	49.9	0.56				####			
7	44.03	0.6				####			
8	49.69	0.7				94.643			
9	48.22	0.71				92.78			
10	58.48	0.6				93.96			
11	56.28	0.63				97.222			
12	52.14	0.55				86.667			
13	62.65	0.47				80.682			
14	63.63	0.64				####			
15	57.49	0.8				76.623			
16	67.19	0.51				70.313			
17	62.26	0.6				53.333			
18	50.46	0.55				65.844			
19	50.19	0.45				91.852			

Diagram 4.

Define the column's formula

- 'Activate' the empty cell immediately below the new column's title by 'clicking' on it.
- Type " = " and then the formula, noting that :

  a) The column's formula is defined in terms of the *first row* of values in the table. It is then copied for each cell below it.

  b) When a formula variable occurs as a column in the table it's leading value is 'clicked' to include it in the formula. Eg. TiO_2 occurs as column C in the table. Therefore to include this as a formula variable, cell C2 must be 'clicked'.

  c) * = multiplication
  / = division

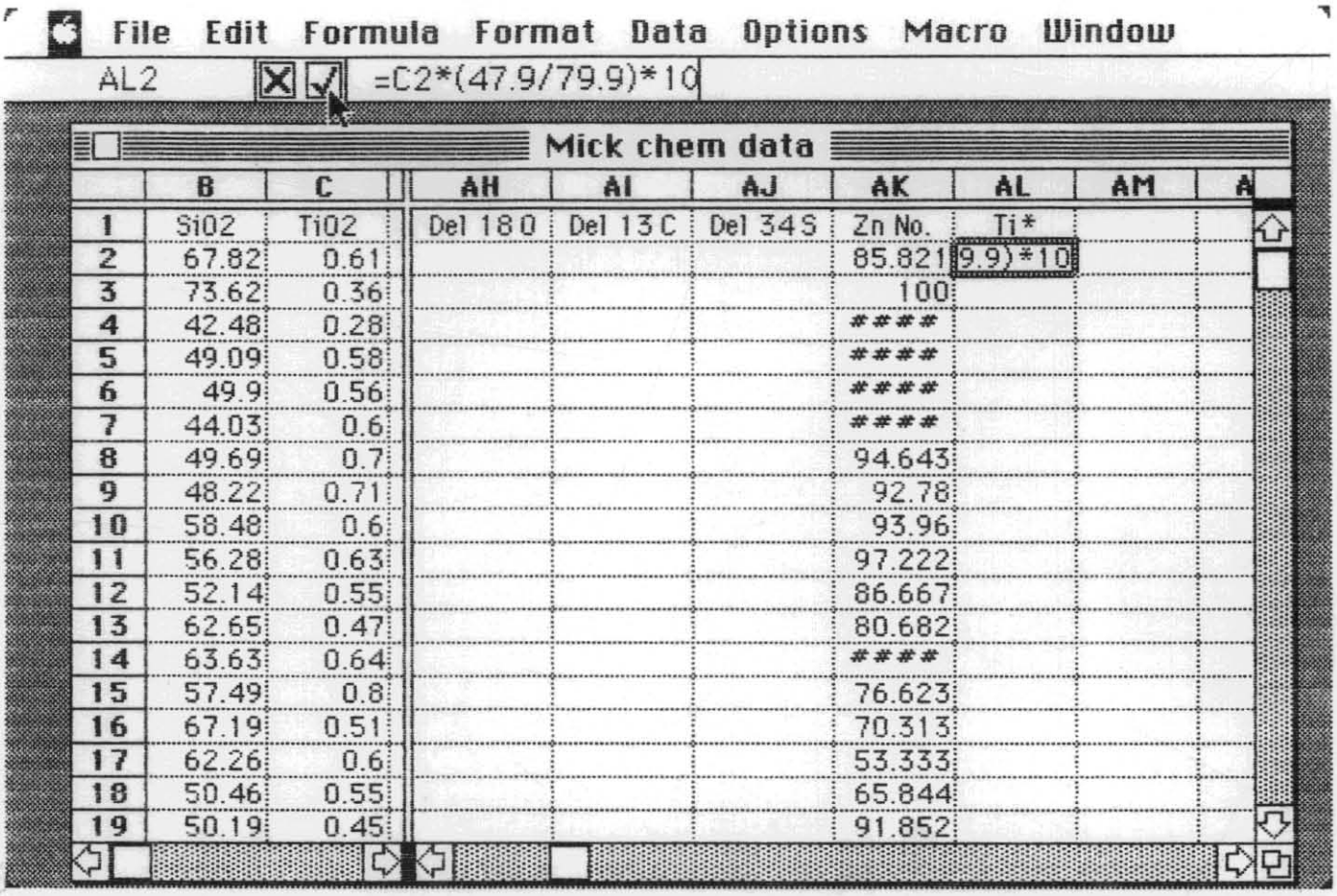
  d) Brackets should be used for clarity.

  e) Many 'inbuilt' functions are available to aid you when constructing formulae.
  Ref pp 231 'Excel User's Guide',
  pp 32 onwards 'Arrays, Functions, and Macros' book.

- The formula will appear at the top of the screen and may be edited in the usual Mac way. (diag 5)
- When it is correct, the formula is entered by 'clicking' on the tick at the top of the screen. The formula may be rejected by 'clicking' on the cross instead.

Copy this formula down the rest of the column

- 'Highlight' the column by pointing to this first value and 'dragging' the pointer down the screen whilst keeping the mouse button pressed. Release the button when the column has been completely 'highlighted. (diag 6,7)
- Copy the formula down the column by selecting *"Fill down"* from the *"Edit"* menu.
- 'Click' anywhere away from the column to 'unhighlight' it.
- Move the pointer to the head of the column.



	B	C	AH	AI	AJ	AK	AL	AM	A
1	SiO2	TiO2	Del 18 O	Del 13 C	Del 34 S	Zn No.	Ti*		
2	67.82	0.61				85.821	9.9)*10		
3	73.62	0.36				100			
4	42.48	0.28				####			
5	49.09	0.58				####			
6	49.9	0.56				####			
7	44.03	0.6				####			
8	49.69	0.7				94.643			
9	48.22	0.71				92.78			
10	58.48	0.6				93.96			
11	56.28	0.63				97.222			
12	52.14	0.55				86.667			
13	62.65	0.47				80.682			
14	63.63	0.64				####			
15	57.49	0.8				76.623			
16	67.19	0.51				70.313			
17	62.26	0.6				53.333			
18	50.46	0.55				65.844			
19	50.19	0.45				91.852			

Diagram 5.

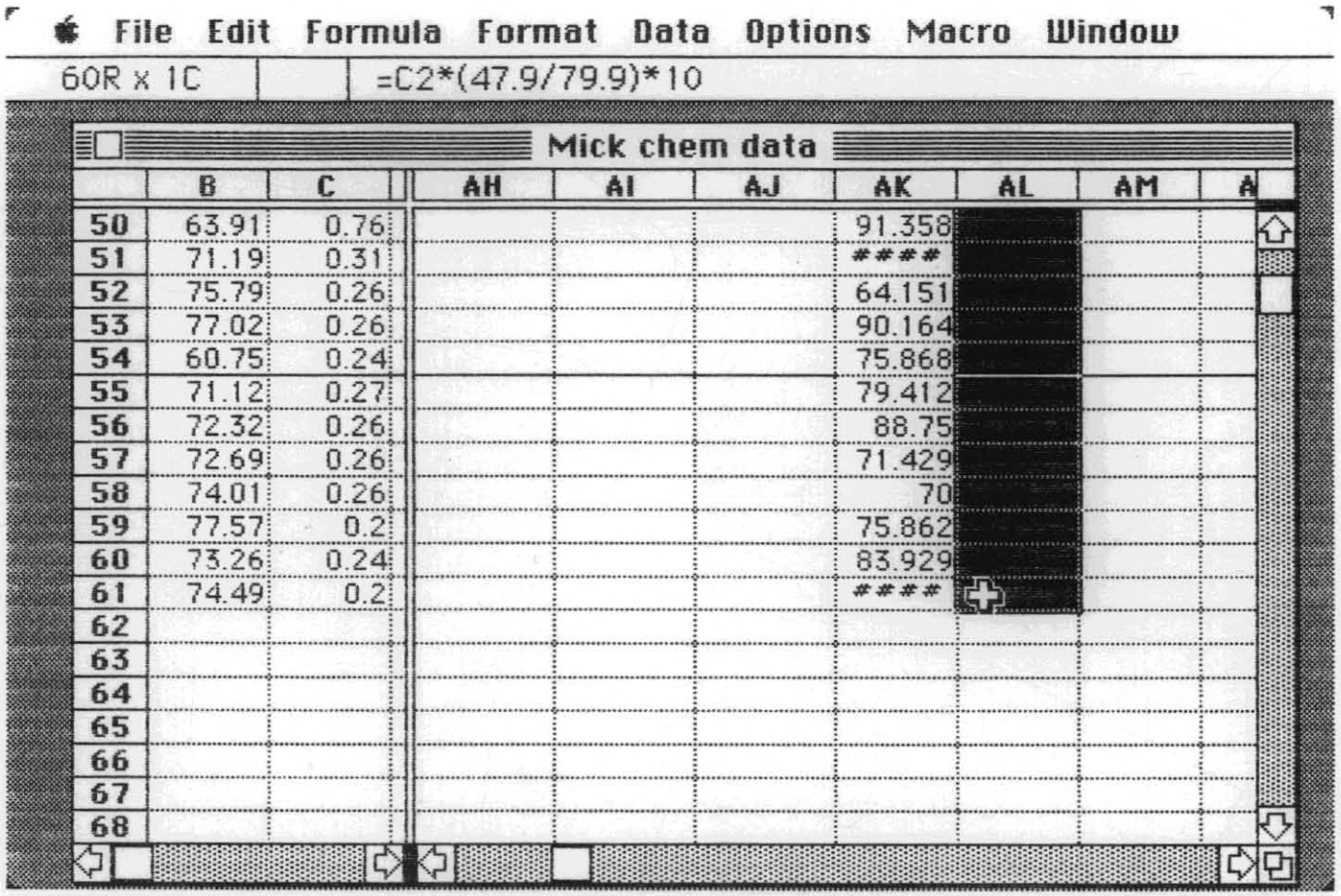
File Edit Formula Format Data Options Macro Window

18R x 1C | =C2*(47.9/79.9)*10

Mick chem data

	B	C	AH	AI	AJ	AK	AL	AM	A
1	SiO2	TiO2	Del 18 O	Del 13 C	Del 34 S	Zn No.	Ti*		
2	67.82	0.61				85.821	3.6569		
3	73.62	0.36				100			
4	42.48	0.28				####			
5	49.09	0.58				####			
6	49.9	0.56				####			
7	44.03	0.6				####			
8	49.69	0.7				94.643			
9	48.22	0.71				92.78			
10	58.48	0.6				93.96			
11	56.28	0.63				97.222			
12	52.14	0.55				86.667			
13	62.65	0.47				80.682			
14	63.63	0.64				####			
15	57.49	0.8				76.623			
16	67.19	0.51				70.313			
17	62.26	0.6				53.333			
18	50.46	0.55				65.844			
19	50.19	0.45				91.852			

Diagram 6.



	B	C	AH	AI	AJ	AK	AL	AM	A
50	63.91	0.76				91.358			
51	71.19	0.31				####			
52	75.79	0.26				64.151			
53	77.02	0.26				90.164			
54	60.75	0.24				75.868			
55	71.12	0.27				79.412			
56	72.32	0.26				88.75			
57	72.69	0.26				71.429			
58	74.01	0.26				70			
59	77.57	0.2				75.862			
60	73.26	0.24				83.929			
61	74.49	0.2				####			
62									
63									
64									
65									
66									
67									
68									

Diagram 7.

Move the columns to be plotted onto the screen

- Manipulate the left and right windows so that both the "Zr" and "Ti*" columns are displayed on the screen.
- 'Shrink' the table to give room for the chart on the screen. (diag 8)

Create a blank chart

- ***'Click' on an empty cell in the table***. (diag 8) This ensures that the point (0,0) will be plotted rather than some strange point involving the 'active' cell. The point (0,0) can be easily removed from the chart later.
- Select *"new"* from the *"file"* menu.
- 'Click' on *"chart"* then *"OK"*.
- A blank chart will now appear on the screen. Shrink this chart and move both the chart and the table around the screen until both can be clearly seen. (diag 9)

'Activating' charts/tables

- 'Click' on chart or table to 'activate' it.

Define the type and format of graph to be plotted

- 'Activate' the chart.
- Select the type of graph to be plotted by selecting from the *"Gallery"* menu. Eg. Scattergram
- Select the format to be used by 'clicking' in the appropriate box. Eg. Log-Log, Log-Normal etc.
- 'Click' on *"OK"*.

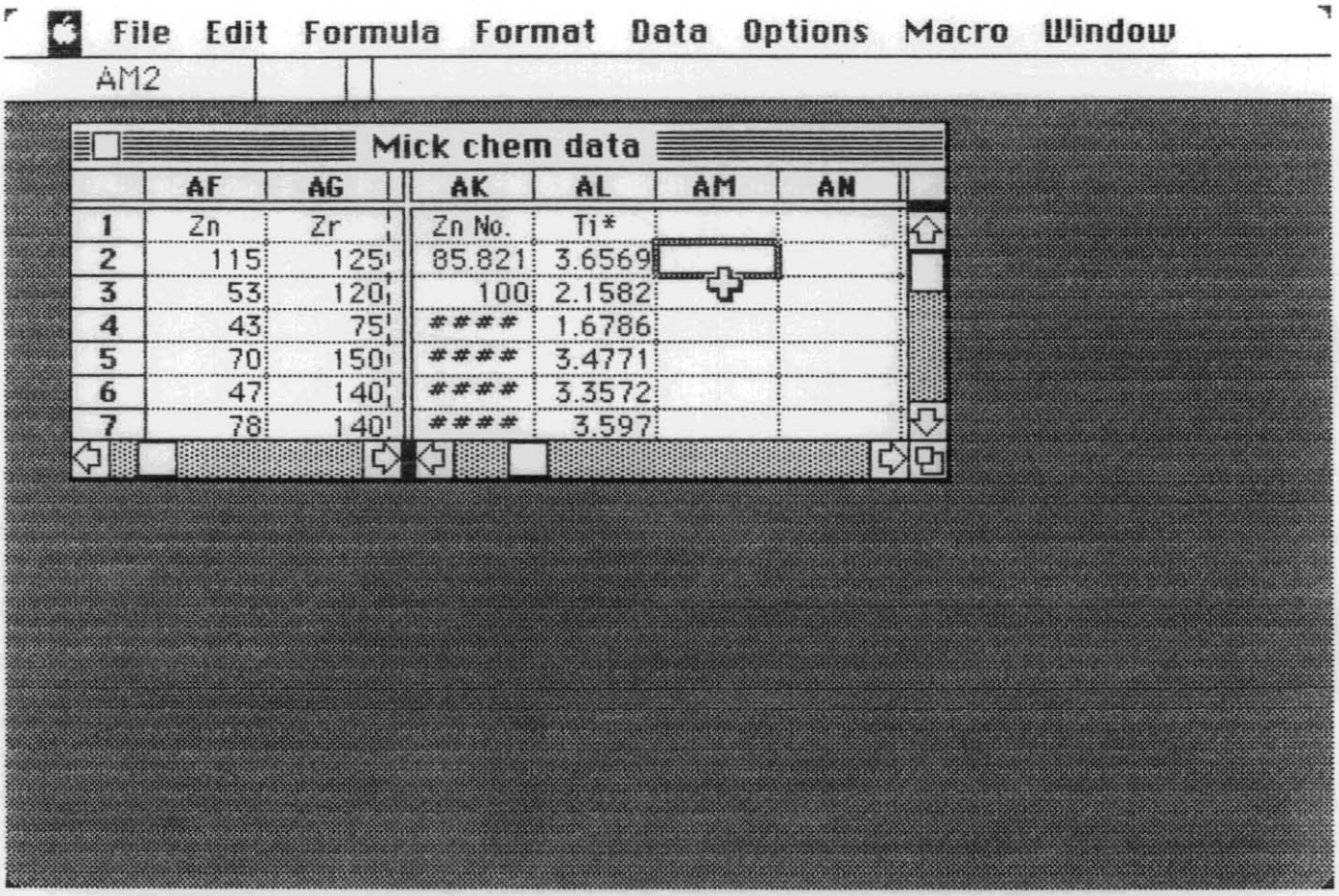

File Edit Formula Format Data Options Macro Window
AM2
Mick chem data
AF AG AK AL AM AN
1 Zn Zr Zn No. Ti*
2 115 125 85.821 3.6569
3 53 120 100 2.1582
4 43 75 #### 1.6786
5 70 150 #### 3.4771
6 47 140 #### 3.3572
7 78 140 #### 3.597

Diagram 8.

File Edit Gallery Chart Format Macro Window

Mick chem data

	AF	AG	AK	AL	AM
1	Zn	Zr	Zn No.	Ti*	
2	115	125	85.821	3.6569	
3	53	120	100	2.1582	
4	43	75	####	1.6786	
5	70	150	####	3.4771	
6	47	140	####	3.3572	
7	78	140	####	3.597	
8	159	105	94.643	4.1965	
9	257	185	92.78	4.2564	
10	140	170	93.96	3.597	
11	140	135	97.222	3.7768	
12	156	115	86.667	3.2972	
13	71	84	80.682	2.8176	
14	115	96	####	3.8368	
15	59	160	76.623	4.796	
16	45	145	70.313	3.0574	
17	240	120	53.333	3.597	
18	160	78	65.844	3.2972	
19	124	62	91.852	2.6977	
20	478	61	82.986	2.6977	

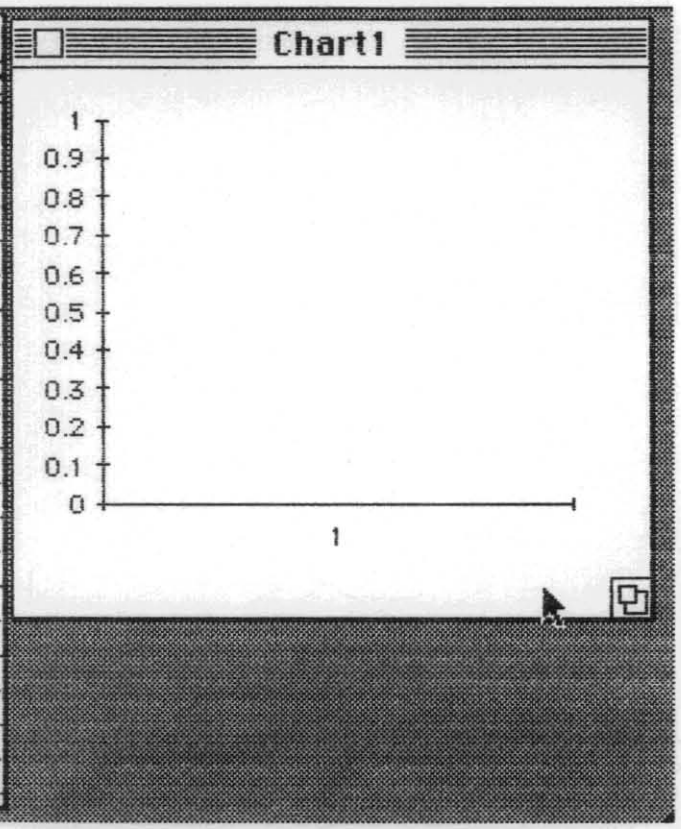


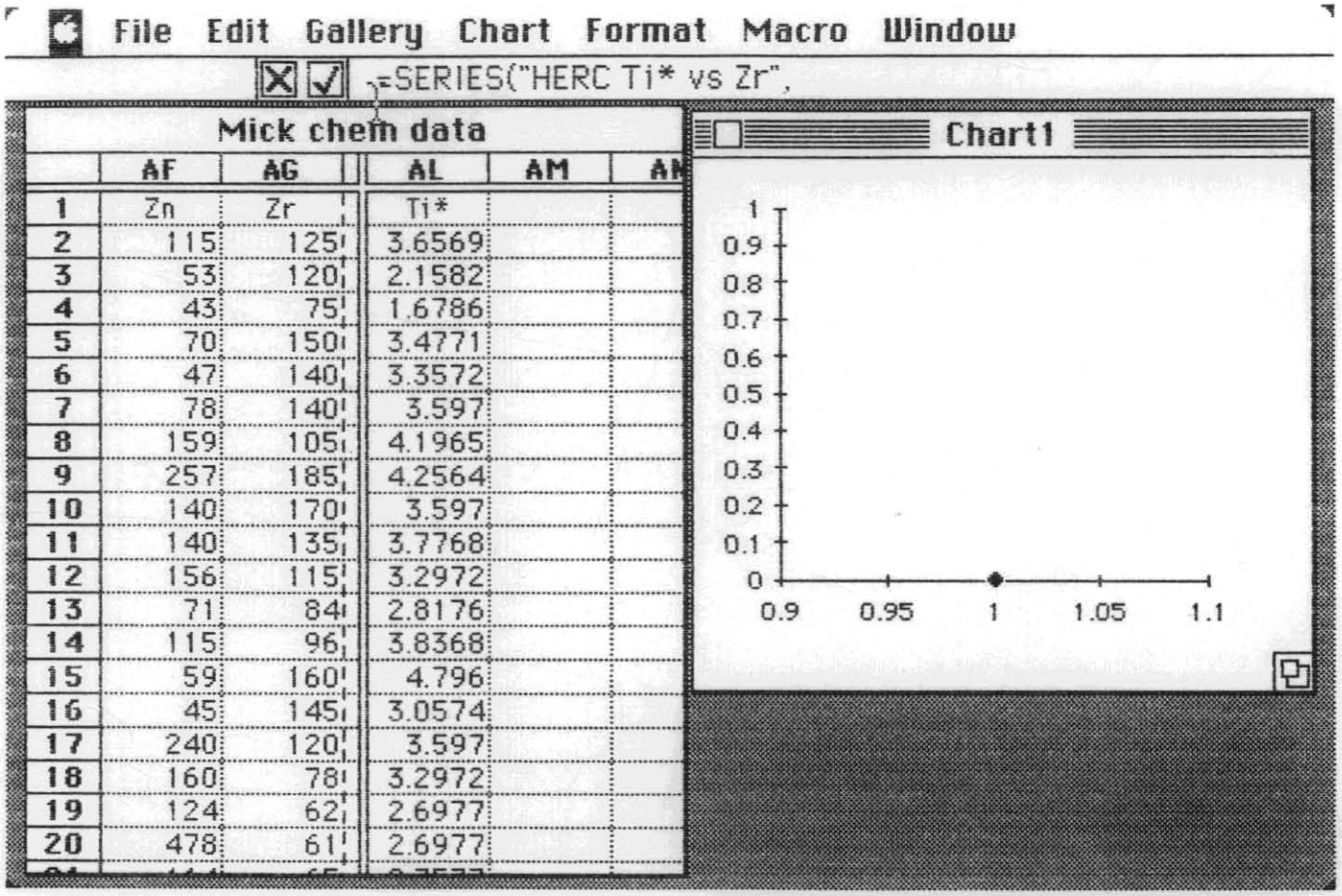
Diagram 9.

Select information to be graphed

- The data to be graphed is defined by building up a "series" which identifies (in order)
  a) The name of the data points.
  b) The file from which the x-axis data is drawn.
  c) The exact co-ordinates of the x-axis data in this file.
  d) The file from which the y-axis data is drawn.
  e) The exact co-ordinates of the y-axis data in this file.

& finally f) The data series number.
ie. Several different sets of data points can be plotted on the same set of axes by adding other series, with different numbers, to the graph.

- Eg. Plotting only Hercules data. (rows 48-54 in the table)
- Select the chart.
- Type " *=SERIESY* "
- Enter the name of the data points in double quotes. Eg. *"HERC Ti* vs Zr"*
- Type a comma. (diag 10)
- 'Activate' the table.
- 'Highlight' the **x-axis** data points to be plotted. The name of the file from which these points are drawn, and their position in the file, will automatically be added to the series. (diag 11)
- Type a comma.
- 'Highlight' the **y-axis** data points to be plotted.
- Type another comma.
- Enter the data series number and close the brackets. (diag12)
- If the series formula is OK then 'clicking' on the tick at the top of the screen will result in the graph being plotted. Otherwise the formula can be rejected by 'clicking' on the cross, or edited in the normal Mac manner.



	AF	AG	AL	AM	AN
1	Zn	Zr	Ti*		
2	115	125	3.6569		
3	53	120	2.1582		
4	43	75	1.6786		
5	70	150	3.4771		
6	47	140	3.3572		
7	78	140	3.597		
8	159	105	4.1965		
9	257	185	4.2564		
10	140	170	3.597		
11	140	135	3.7768		
12	156	115	3.2972		
13	71	84	2.8176		
14	115	96	3.8368		
15	59	160	4.796		
16	45	145	3.0574		
17	240	120	3.597		
18	160	78	3.2972		
19	124	62	2.6977		
20	478	61	2.6977		

Diagram 10.

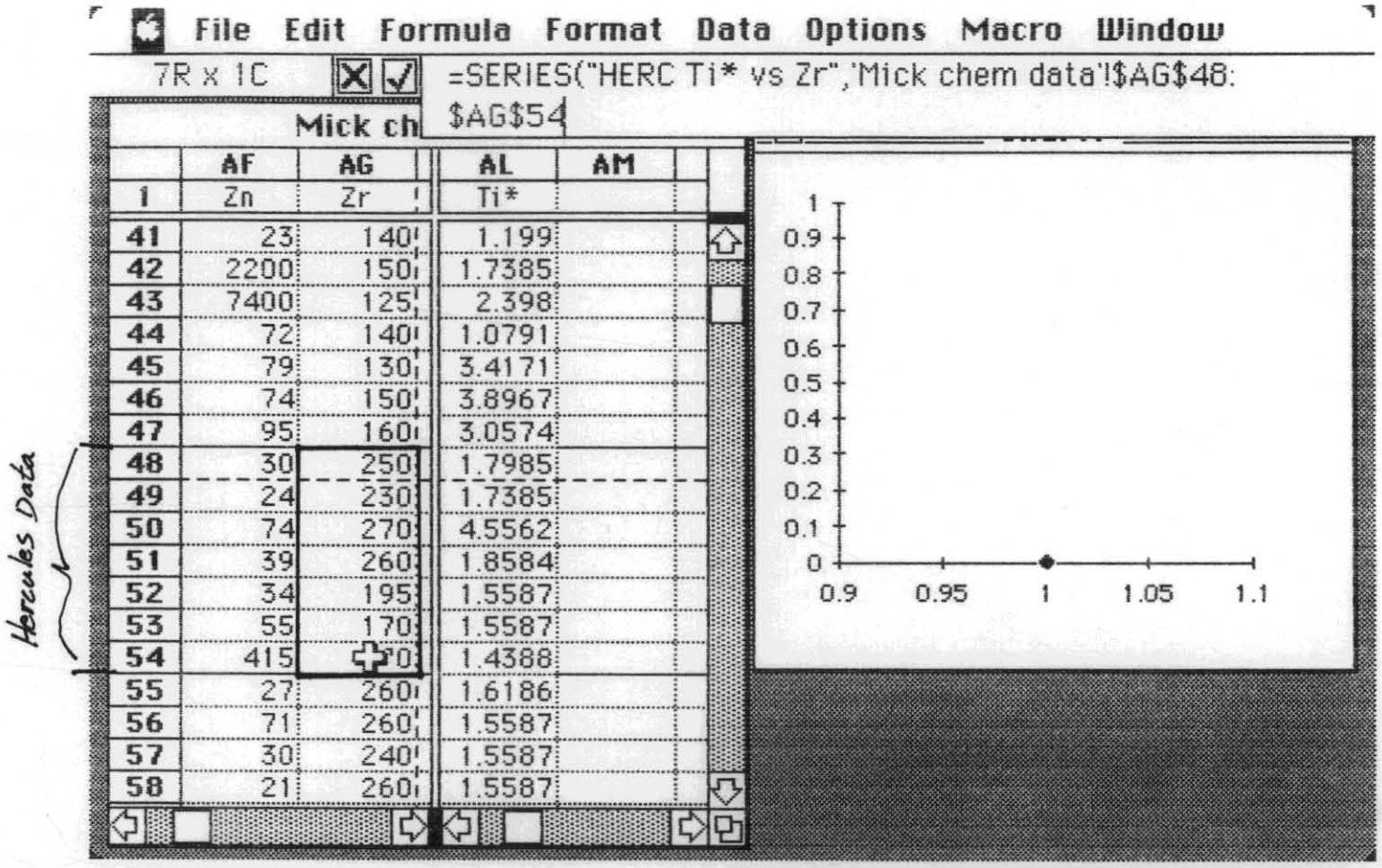

File Edit Formula Format Data Options Macro Window
7R x 1C
=SERIES("HERC Ti* vs Zr",'Mick chem data'!$AG$48:
$AG$54
Mick ch
AF AG AL AM
1 Zn Zr Ti*
41 23 140 1.199
42 2200 150 1.7385
43 7400 125 2.398
44 72 140 1.0791
45 79 130 3.4171
46 74 150 3.8967
47 95 160 3.0574
48 30 250 1.7985
49 24 230 1.7385
50 74 270 4.5562
51 39 260 1.8584
52 34 195 1.5587
53 55 170 1.5587
54 415 70 1.4388
55 27 260 1.6186
56 71 260 1.5587
57 30 240 1.5587
58 21 260 1.5587
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.9
0.95
1
1.05
1.1
Hercules Data

Diagram 11.

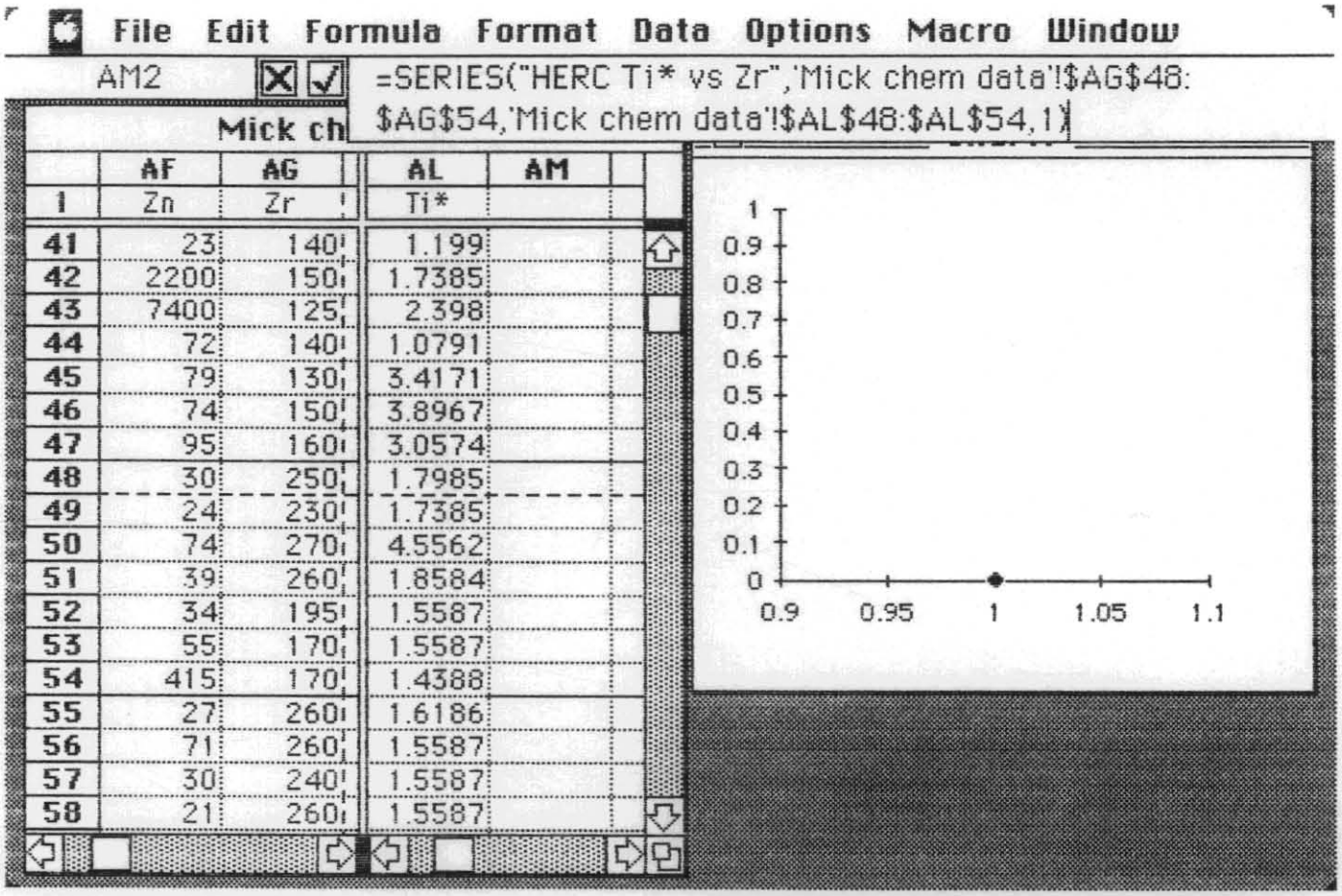

File Edit Formula Format Data Options Macro Window
AM2
=SERIES("HERC Ti* vs Zr",'Mick chem data'!$AG$48:
$AG$54,'Mick chem data'!$AL$48:$AL$54,1)
Mick ch
AF AG AL AM
1 Zn Zr Ti*
41 23 140 1.199
42 2200 150 1.7385
43 7400 125 2.398
44 72 140 1.0791
45 79 130 3.4171
46 74 150 3.8967
47 95 160 3.0574
48 30 250 1.7985
49 24 230 1.7385
50 74 270 4.5562
51 39 260 1.8584
52 34 195 1.5587
53 55 170 1.5587
54 415 170 1.4388
55 27 260 1.6186
56 71 260 1.5587
57 30 240 1.5587
58 21 260 1.5587
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.9
0.95
1
1.05
1.1

Diagram 12.

Removing the erroneous point (0,0) from the graph
(Ref. First point in the *"create a blank chart"* section of this report.)

- 'Activate' the chart.
- 'Click' on the point (0,0) to 'activate' it. It's series should appear at the top of the screen. (diag 13)
- Check that the series spans only one cell of the Excel table. (diag 13)
- Delete the series in the normal Mac manner by highlighting it and pressing the <Backspace> key.
- Enter this deletion by 'clicking' on the tick at the top of the screen.

Embelishments (diag 14)

A) **Revising the graph** - adding text
changing axes
adding a legend
adding an arrow

B) **Creative formatting** - selecting objects in a chart
formatting a chart
formatting the plot area
formatting an axis
formatting data points and series
formatting text
formatting a legend
formatting grid lines
formatting an arrow

- All of the above embelishments are extremely easy to carry out. Pages 171 to 181 of the Excel Users Guide summarise these clearly.

- Firstly select the graph.
- Enlarge and re-position the graph so that it fills the screen.
- Follow the instructions in the Users guide.

File Edit Gallery Chart Format Macro Window

=SERIES(,,'Mick chem data'!$AM$2:$AM$2,2)

Mick chem data

	AF	AG	AK	AL	AM
1	Zn	Zr	Zn No.	Ti*	
1	Zn	Zr	Zn No.	Ti*	
2	115	125	85.821	3.6569	
3	53	120	100	2.1582	
4	43	75	####	1.6786	
5	70	150	####	3.4771	
6	47	140	####	3.3572	
7	78	140	####	3.597	
8	159	105	94.643	4.1965	
9	257	185	92.78	4.2564	
10	140	170	93.96	3.597	
11	140	135	97.222	3.7768	
12	156	115	86.667	3.2972	
13	71	84	80.682	2.8176	
14	115	96	####	3.8368	
15	59	160	76.623	4.796	
16	45	145	70.313	3.0574	
17	240	120	53.333	3.597	
18	160	78	65.844	3.2972	
19	124	62	91.852	2.6977	

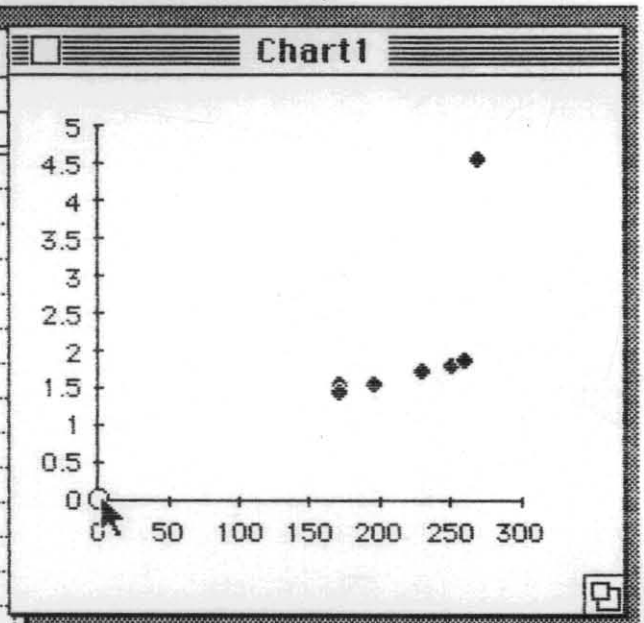
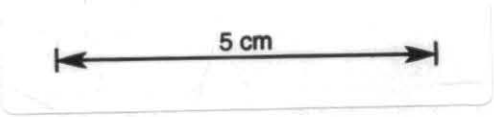


Diagram 13.



HERC Ti* vs Zr

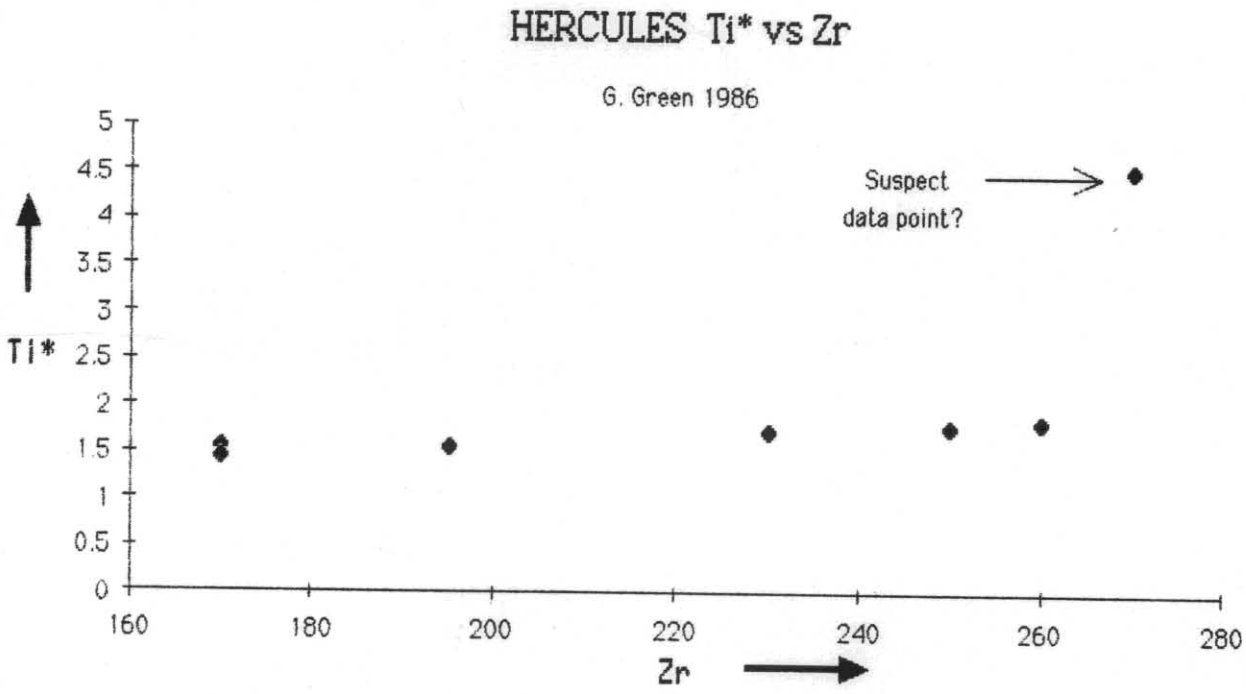
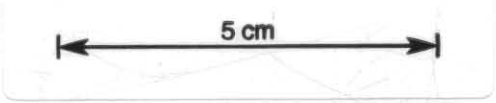


Diagram 14.



Printing the graph

- Select *"print"* from the *"file"* menu.

Saving the graph

- Save an unnamed graph by selecting *"save as..."* from the *"file"* menu.
- Save a named graph by selecting *"save"* from the *"file"* menu.

2) TRIANGULAR PLOTS :

Eg. Graph of Zr' vs Ti/100 vs Y'

where

$$Zr' = [\ Zr/(Ti'+Zr+Y')\ ] \times 100$$

$$Ti/100 = [\ Ti'/(Ti'+Zr+Y')\ ] \times 100$$

$$Y' = Y \times 3$$

$$Ti' = TiO_2 \times (47.9/79.9) \times 100$$

Summary

- Triangular graphs are plotted by creating an extra two columns in the excel table, which convert the three columns to be plotted into an X-Y format.
- These X-Y co-ordinates are then plotted, along with the co-ordinates of the triangle vertices.
- The X-Y axes are then removed and the chart is transferred to *"fullpaint"* to draw and label the new axes. The chart is titled and printed.

Generate the columns to be graphed

- Y', Ti', Zr' and Ti/100 columns are generated according to the formulae above, in the same way that was used when discussing X-Y plots. (diag 15) (ref Section 1 : *"create a new column"* To *"copy this formula down the rest of the column"*)
- Diagram 16 shows the formulae used to plot three columns A, B, C ,in a triangular format, on an X-Y grid.
- Using these formulae, *"ABC=>X"* and *"ABC=>Y"* columns are generated. (diags 17, 18)
- Nb. A square root function generates the value of 'root three' needed for the *"ABC=>Y"* function. The method of using this function is as follows.

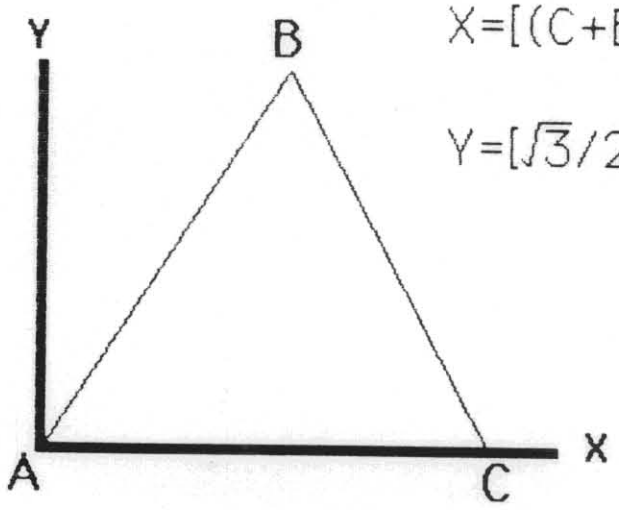
File Edit Formula Format Data Options Macro Window

A056

Mick chem data

	AG	AL	AM	AN	AO	AP	AQ	AR	AS
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100			
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100			
2	125	3.6569	75	36.569	52.839	15.458			
3	120	2.1582	72	21.582	56.185	10.105			
4	75	1.6786	33	16.786	60.103	13.452			
5	150	3.4771	51	34.771	63.621	14.748			
6	140	3.3572	57	33.572	60.719	14.56			
7	140	3.597	57	35.97	60.094	15.44			
8	105	4.1965	33	41.965	58.345	23.318			
9	185	4.2564	72	42.564	61.756	14.209			
10	170	3.597	75	35.97	60.505	12.802			
11	135	3.7768	69	37.768	55.839	15.622			
12	115	3.2972	66	32.972	53.745	15.41			
13	84	2.8176	36	28.176	56.689	19.015			
14	96	3.8368	36	38.368	56.349	22.521			
15	160	4.796	69	47.96	57.77	17.317			
16	145	3.0574	51	30.574	63.997	13.494			
17	120	3.597	42	35.97	60.615	18.169			
18	78	3.2972	42	32.972	50.99	21.555			
19	62	2.6977	36	26.977	49.609	21.586			

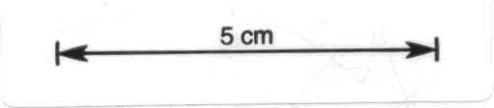
Diagram 15.



$$X=[(C+B/2)/(A+B+C)]*100$$

$$Y=[\sqrt{3}/2 * B/(A+B+C)]*100$$

Diagram 16.



File Edit Formula Format Data Options Macro Window

AQ2 | =((AM2+(AP2/2))/(AO2+AP2+AM2))*100

Mick chem data

	AG	AL	AM	AN	AO	AP	AQ	AR	AS
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X		
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X		
2	125	3.6569	75	36.569	52.839	15.458	57.733		
3	120	2.1582	72	21.582	56.185	10.105	55.718		
4	75	1.6786	33	16.786	60.103	13.452	37.282		
5	150	3.4771	51	34.771	63.621	14.748	45.122		
6	140	3.3572	57	33.572	60.719	14.56	48.594		
7	140	3.597	57	35.97	60.094	15.44	48.833		
8	105	4.1965	33	41.965	58.345	23.318	38.948		
9	185	4.2564	72	42.564	61.756	14.209	53.462		
10	170	3.597	75	35.97	60.505	12.802	54.887		
11	135	3.7768	69	37.768	55.839	15.622	54.685		
12	115	3.2972	66	32.972	53.745	15.41	54.534		
13	84	2.8176	36	28.176	56.689	19.015	40.739		
14	96	3.8368	36	38.368	56.349	22.521	41.143		
15	160	4.796	69	47.96	57.77	17.317	53.897		
16	145	3.0574	51	30.574	63.997	13.494	44.943		
17	120	3.597	42	35.97	60.615	18.169	42.294		
18	78	3.2972	42	32.972	50.99	21.555	46.076		
19	62	2.6977	36	26.977	49.609	21.586	43.652		

Diagram 17.

File Edit Formula Format Data Options Macro Window

AR2 | =((SQRT(3)/2)*(AP2/(AO2+AP2+AM2)))*100

Mick chem data

	AG	AL	AM	AN	AO	AP	AQ	AR	AS
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X	ABC => Y	
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X	ABC => Y	
2	125	3.6569	75	36.569	52.839	15.458	57.733	9.3423	
3	120	2.1582	72	21.582	56.185	10.105	55.718	6.33803	
4	75	1.6786	33	16.786	60.103	13.452	37.282	18.933	
5	150	3.4771	51	34.771	63.621	14.748	45.122	9.87251	
6	140	3.3572	57	33.572	60.719	14.56	48.594	9.53258	
7	140	3.597	57	35.97	60.094	15.44	48.833	10.0889	
8	105	4.1965	33	41.965	58.345	23.318	38.948	17.6119	
9	185	4.2564	72	42.564	61.756	14.209	53.462	8.31626	
10	170	3.597	75	35.97	60.505	12.802	54.887	7.47566	
11	135	3.7768	69	37.768	55.839	15.622	54.685	9.63178	
12	115	3.2972	66	32.972	53.745	15.41	54.534	9.87398	
13	84	2.8176	36	28.176	56.689	19.015	40.739	14.7424	
14	96	3.8368	36	38.368	56.349	22.521	41.143	16.9788	
15	160	4.796	69	47.96	57.77	17.317	53.897	10.408	
16	145	3.0574	51	30.574	63.997	13.494	44.943	9.09508	
17	120	3.597	42	35.97	60.615	18.169	42.294	13.0275	
18	78	3.2972	42	32.972	50.99	21.555	46.076	16.2966	
19	62	2.6977	36	26.977	49.609	21.586	43.652	17.4392	

Diagram 18.

a) Select *"paste function"* from the *"formula"* menu.
b) 'Scroll' down the list of functions until *"SQRT()"* is found.
c) 'Click' on this function to 'highlight' it. (diag 19)
d) 'Click' *"OK"*.
e) Type *"3"*.
f) 'Click' pointer on the right hand side of the brackets and continue entering the formula.

Enter the three vertex co-ordinates.

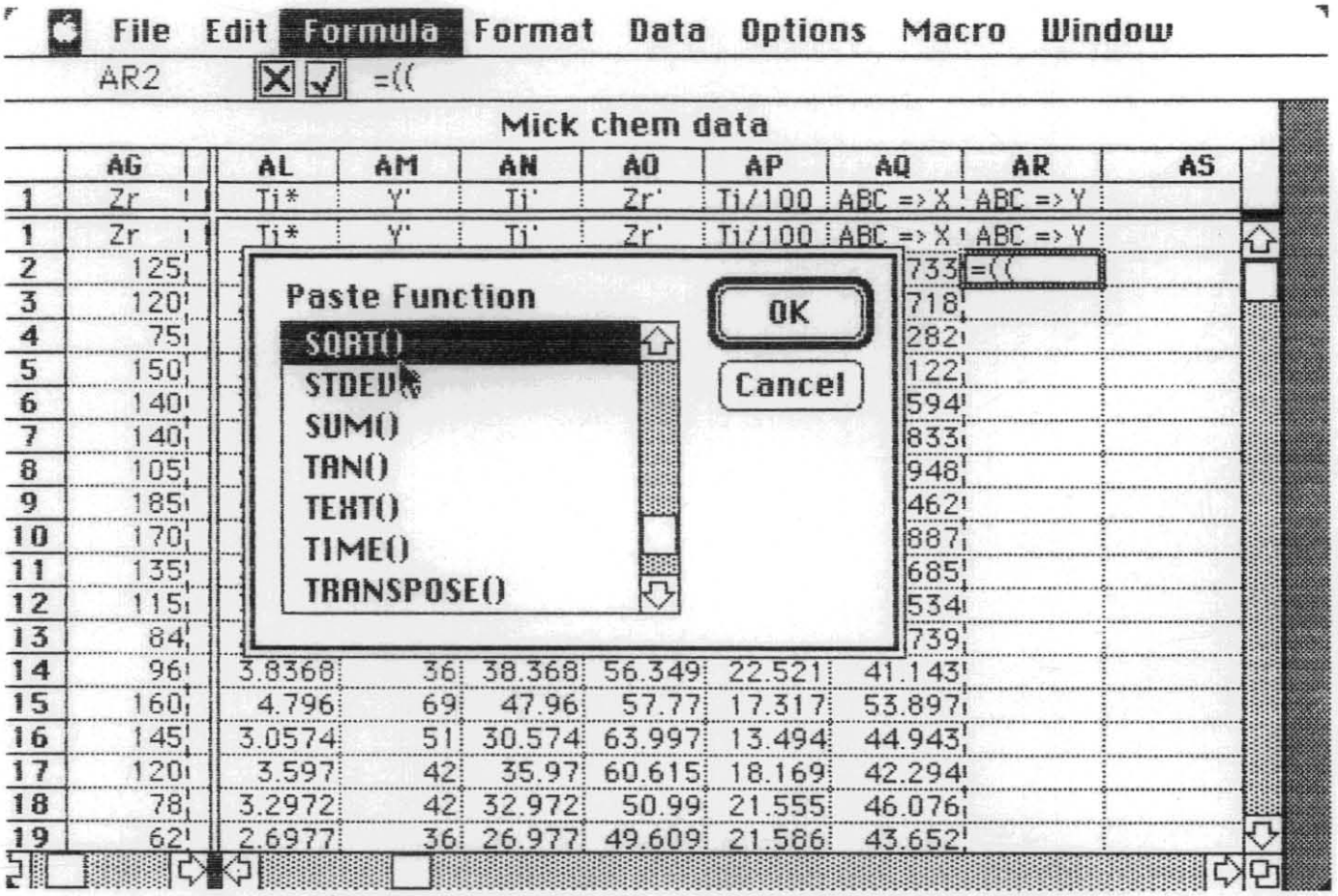
- The triangle is plotted on a 100 x 100 grid. Therefore the vertex co-ordinates are as follows:

  Vertex A - (0,0)
  Vertex B - (50,100√3/2) = (50,86.603)
  Vertex C - (100,0)

- For convenience these are tabulated separately underneath the *"ABC=>X"* and *"ABC=>Y"* columns. (diag 20)
- The columns are saved by selecting *"save"* from the *"file"* menu.

Create the blank graph

- 'Activate' an empty cell in the Excel table.
- Select *"new"* from the *"file"* menu.
- 'Click' on the *"chart"* indicator, followed by *"OK"*.
- Highlight the first format shown when *"scatter..."* is selected from the *"gallery"* menu.
- Manipulate both the Excel table and the chart until both are seen on the screen. (diag 21)
- Delete the "active cell point" shown on the graph. (diag 21-23)
  (Ref. Section 1: *"Removing the erroneous point (0,0) from the graph"*)



	AG	AL	AM	AN	AO	AP	AQ	AR	AS
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X	ABC => Y	
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X	ABC => Y	
2	125						733	=((	
3	120						718		
4	75						282		
5	150						122		
6	140						594		
7	140						833		
8	105						948		
9	185						462		
10	170						887		
11	135						685		
12	115						534		
13	84						739		
14	96	3.8368	36	38.368	56.349	22.521	41.143		
15	160	4.796	69	47.96	57.77	17.317	53.897		
16	145	3.0574	51	30.574	63.997	13.494	44.943		
17	120	3.597	42	35.97	60.615	18.169	42.294		
18	78	3.2972	42	32.972	50.99	21.555	46.076		
19	62	2.6977	36	26.977	49.609	21.586	43.652		

Diagram 19.

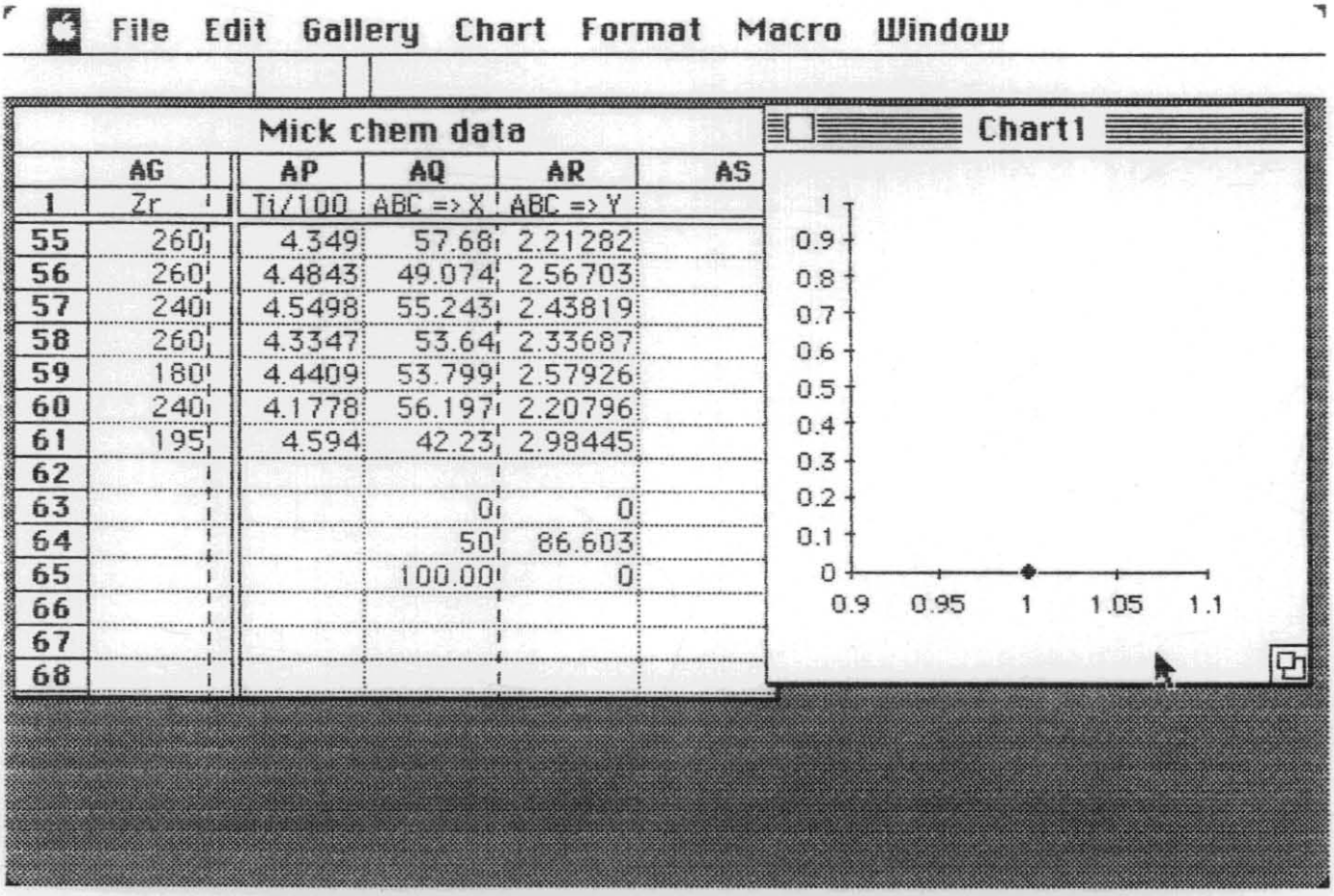
File Edit Formula Format Data Options Macro Window

AQ66

Mick chem data

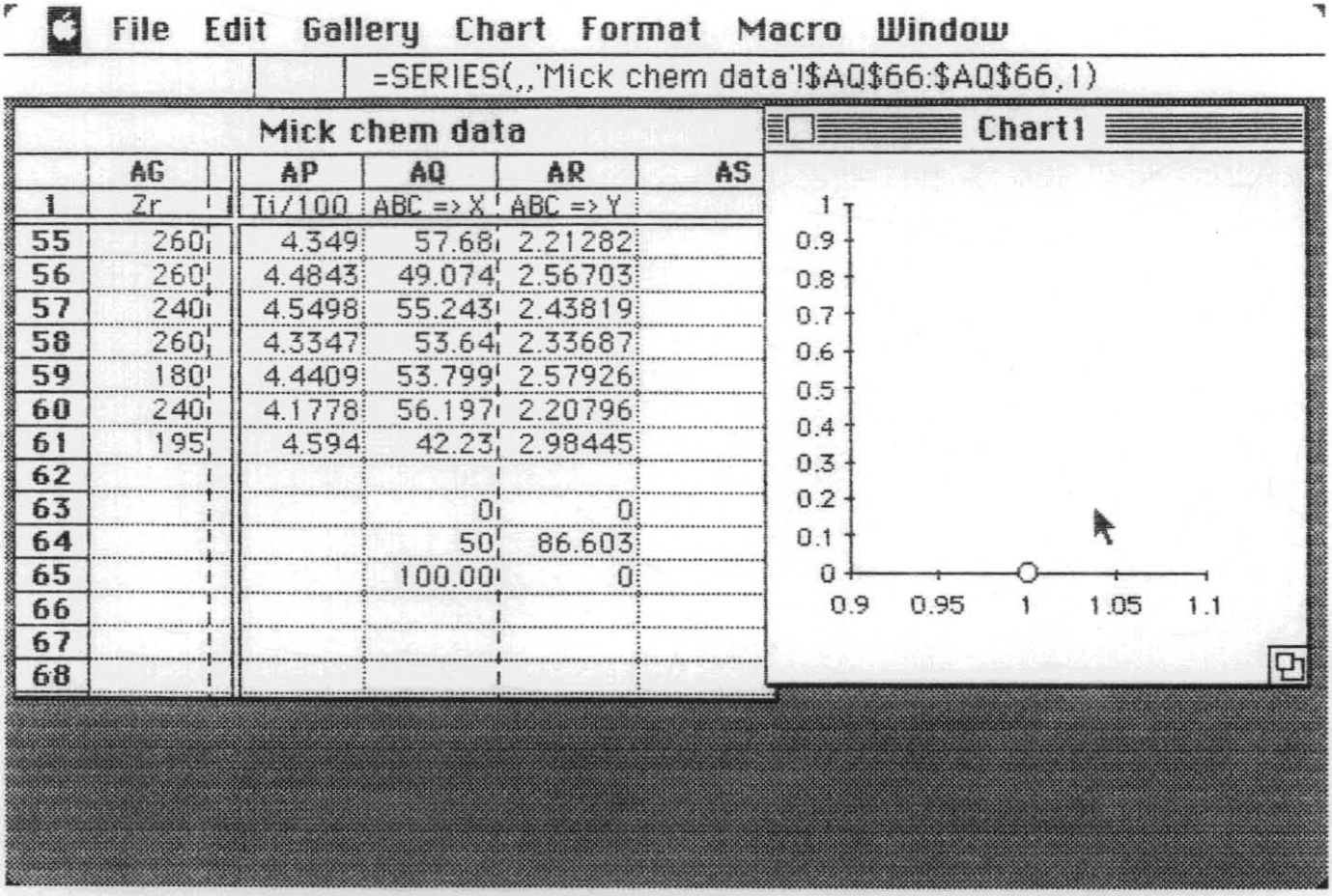
	AG	AL	AM	AN	AO	AP	AQ	AR	AS
1	Zr	Ti*	Y'	Ti'	Zr'	Ti/100	ABC => X	ABC => Y	
55	260	1.6186	96	16.186	69.857	4.349	57.68	2.21282	
56	260	1.5587	72	15.587	74.801	4.4843	49.074	2.56703	
57	240	1.5587	87	15.587	70.055	4.5498	55.243	2.43819	
58	260	1.5587	84	15.587	72.305	4.3347	53.64	2.33687	
59	180	1.199	78	11.99	66.669	4.4409	53.799	2.57926	
60	240	1.4388	90	14.388	69.689	4.1778	56.197	2.20796	
61	195	1.199	54	11.99	74.716	4.594	42.23	2.98445	
62									
63							0	0	
64							50	86.603	
65							100.00	0	
66									
67									
68									
69									
70									
71									
72									
73									

Diagram 20.



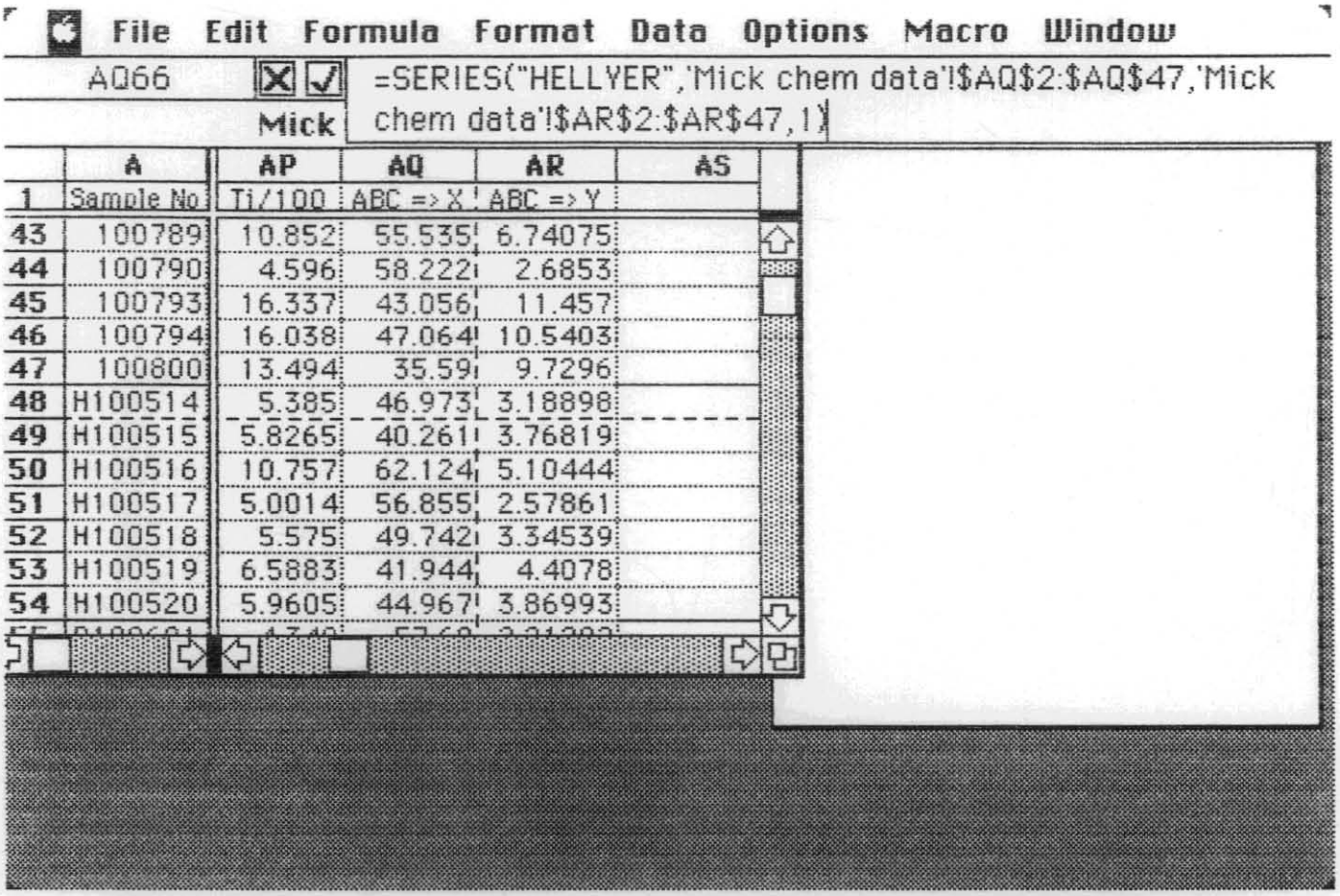
	AG	AP	AQ	AR	AS
1	Zr	Ti/100	ABC => X	ABC => Y	
55	260	4.349	57.68	2.21282	
56	260	4.4843	49.074	2.56703	
57	240	4.5498	55.243	2.43819	
58	260	4.3347	53.64	2.33687	
59	180	4.4409	53.799	2.57926	
60	240	4.1778	56.197	2.20796	
61	195	4.594	42.23	2.98445	
62					
63			0	0	
64			50	86.603	
65			100.00	0	
66					
67					
68					

Diagram 21.



	AG	AP	AQ	AR	AS
1	Zr	Ti/100	ABC => X	ABC => Y	
55	260	4.349	57.68	2.21282	
56	260	4.4843	49.074	2.56703	
57	240	4.5498	55.243	2.43819	
58	260	4.3347	53.64	2.33687	
59	180	4.4409	53.799	2.57926	
60	240	4.1778	56.197	2.20796	
61	195	4.594	42.23	2.98445	
62					
63			0	0	
64			50	86.603	
65			100.00	0	
66					
67					
68					

Diagram 22.



	A	AP	AQ	AR	AS
1	Sample No	Ti/100	ABC => X	ABC => Y	
43	100789	10.852	55.535	6.74075	
44	100790	4.596	58.222	2.6853	
45	100793	16.337	43.056	11.457	
46	100794	16.038	47.064	10.5403	
47	100800	13.494	35.59	9.7296	
48	H100514	5.385	46.973	3.18898	
49	H100515	5.8265	40.261	3.76819	
50	H100516	10.757	62.124	5.10444	
51	H100517	5.0014	56.855	2.57861	
52	H100518	5.575	49.742	3.34539	
53	H100519	6.5883	41.944	4.4078	
54	H100520	5.9605	44.967	3.86993	

Diagram 23.

Plot the data points

- It is important that the data points are plotted before the points defining the triangle, so that they will become the primary series and hence will be clearer on the graph. The Triangle points will be deleted later on.
- For this example only the "Hellyer" data points will be plotted. (rows 2 to 47)
- 'Activate' the chart.
- Type " *=SERIES(" name of series",* " Eg. *"Hellyer"*
- 'Highlight' the Hellyer X and Y co-ordinates, (rows 2 to 47), separated by a comma.
- Type a comma.
- Enter the series number, 1, and close the brackets. (diag 23)
- 'Click' on the tick to enter the series if it is correct. Otherwise, correct it by editing in the normal Mac way before entering.

Plot the triangle points (diag 24)

- Enter a second series, defining the triangles' co-ordinates, in a similar way to the first.
- It is not necessary to name this series, in which case a leading comma **must** be placed after the open bracket.
- This series **must** be given a different number to the previous one or it will not be accepted.

Remove the X-Y axes

- Select *"axes"* from the *"chart"* menu.
- Clear the six boxes which appear in the dialog box by 'clicking' on any box with a cross in it. (diag 25)
- 'Click' on *"OK"* to get back to the chart.

File Edit Formula Format Data Options Macro Window

AQ66 =SERIES(,'Mick chem data'!$AQ$63:$AQ$65,'Mick chem data'!$AR$63:$AR$65,2)

Mick

	A	AP	AQ	AR	AS
1	Sample No	Ti/100	ABC => X	ABC => Y	
55	B100601	4.349	57.68	2.21282	
56	B100602	4.4843	49.074	2.56703	
57	B100605	4.5498	55.243	2.43819	
58	B100608	4.3347	53.64	2.33687	
59	B100610	4.4409	53.799	2.57926	
60	B100612	4.1778	56.197	2.20796	
61	B100614	4.594	42.23	2.98445	
62					
63			0	0	
64			50	86.603	
65			100.00	0	
66					

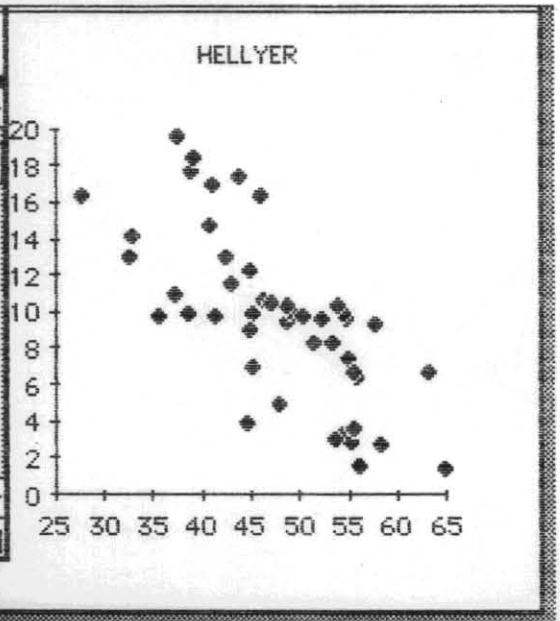
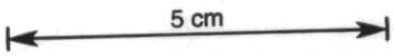


Diagram 24.



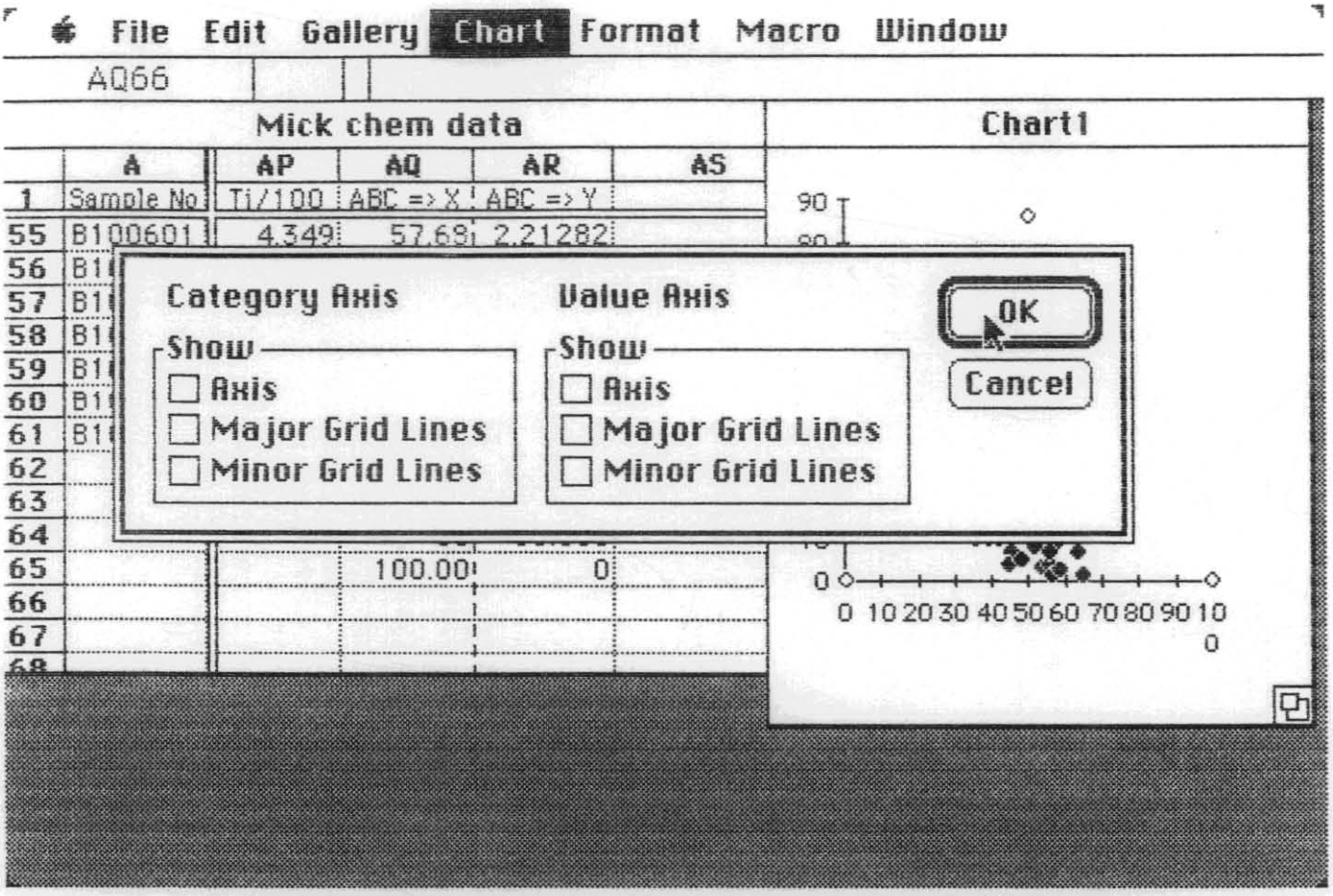

File Edit Gallery Chart Format Macro Window
AQ66
Mick chem data
Chart1
A
AP
AQ
AR
AS
1
Sample No
Ti/100
ABC => X
ABC => Y
55
B100601
4.349
57.68
2.21282
65
100.00
0
90
0
0 10 20 30 40 50 60 70 80 90 10 0
Category Axis
Value Axis
Show
Axis
Major Grid Lines
Minor Grid Lines
Show
Axis
Major Grid Lines
Minor Grid Lines
OK
Cancel

Diagram 25.

Prepare the chart for transfer to *"Fullpaint"* (diag **26**)

- Adjust the dimensions of the graph on the screen until it is an equilateral triangle.
- This may be a "fiddly" job but it is worth persevering.
- Don't make the graph too big or you may experience troubles when trying to join the vertices later on.
- Use the *"save as..."* command from the *"file"* menu to save and name the graph.

Transfer the graph to *"Fullpaint"* (to draw and label the axes etc.)

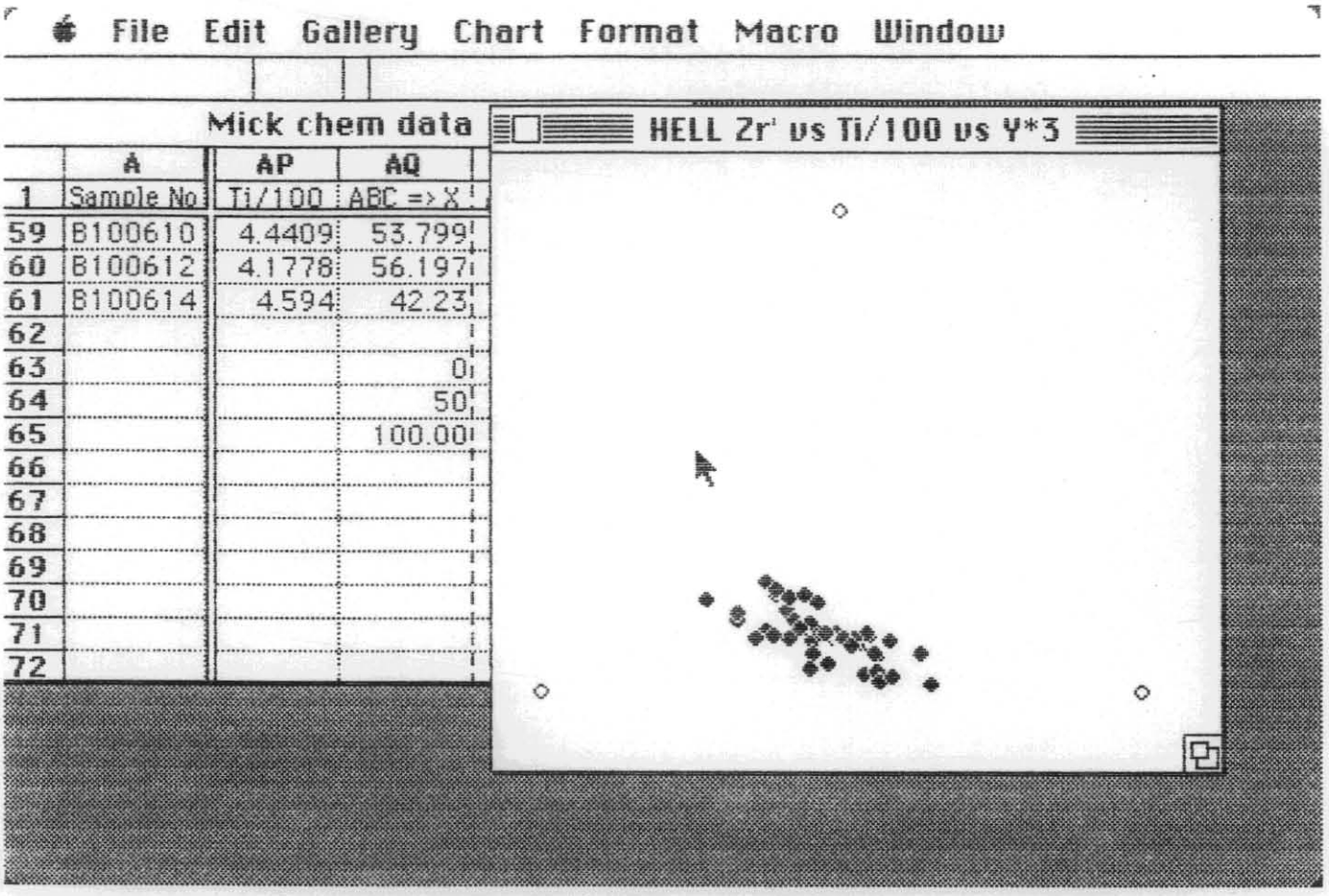
- This is a two-stage process :

a) Transfer from Excel to scrapbook

- Select the *"copy chart..."* option from the *"edit"* menu.
- 'Click' on the *"as shown on screen"* box.
- Select the *"scrapbook"* from the *"apple"* menu.
- Paste the chart into the scrapbook by selecting *"paste"* from the *"edit"* menu.
- Quit the Excel file by selecting *"quit"* from the *"file"* menu and 'clicking' the "close box".
- Close the rest of the open files on the desk top by 'clicking' on their "close boxes".

b) Transfer from the scrapbook to *"Fullpaint"*

- Open *"Fullpaint"* by 'clicking' on the *"hard disc"*, *"graphics folder"*, *"Fpaint folder"* and *"Fullpaint"* icons respectively.
- Select *"paste"* from the *"edit"* menu.
- A copy of the graph will now appear within a moving rectangle on the *"Fullpaint"* screen. (diag 27)
- This rectangle is removed by 'Clicking' outside of it.
- Diagram 28 names the major tools used in *"Fullpaint"*.



	A	AP	AQ
1	Sample No	Ti/100	ABC => X
59	B100610	4.4409	53.799
60	B100612	4.1778	56.197
61	B100614	4.594	42.23
62			
63			0
64			50
65			100.00
66			
67			
68			
69			
70			
71			
72			

Diagram 26.

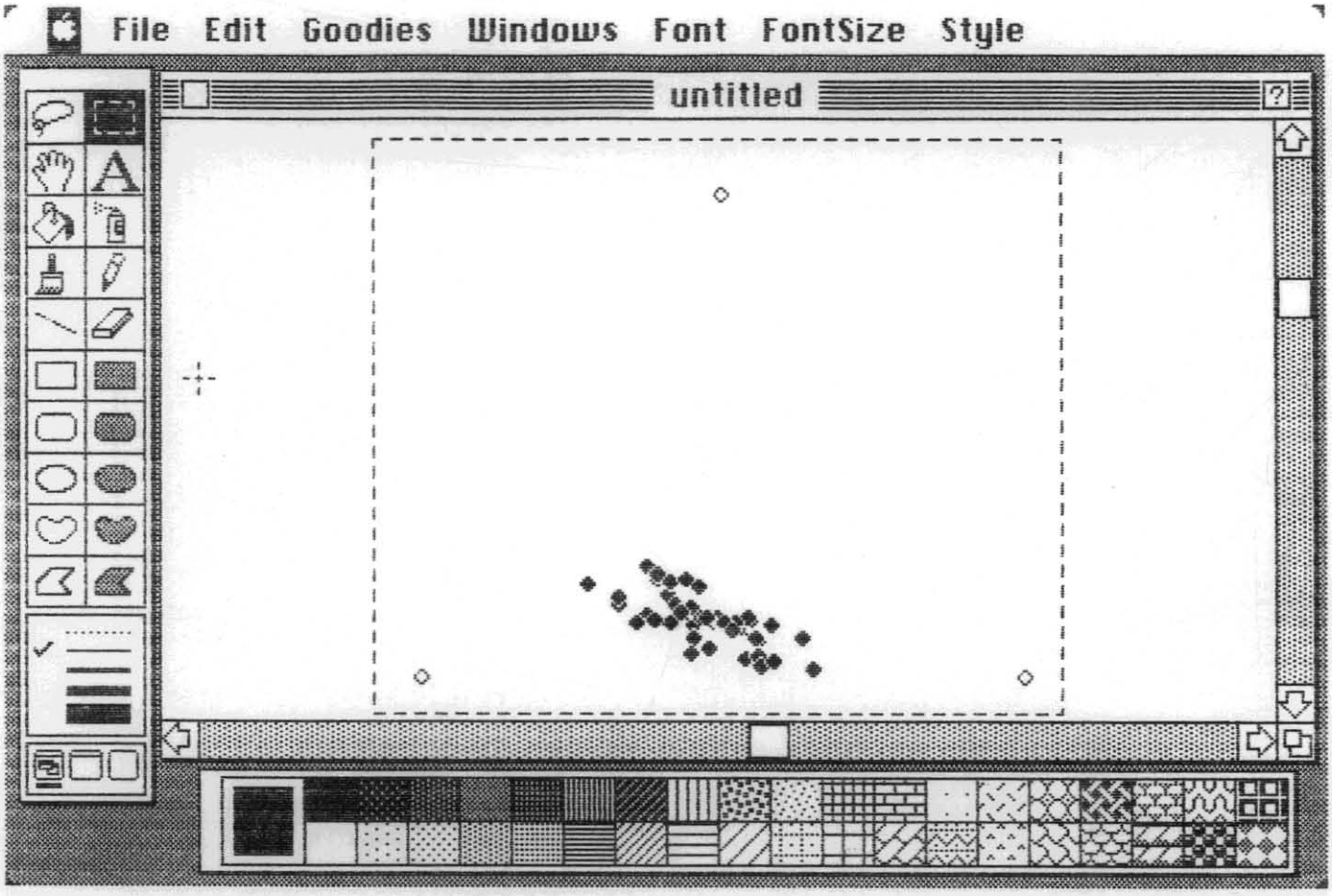


Diagram 27.

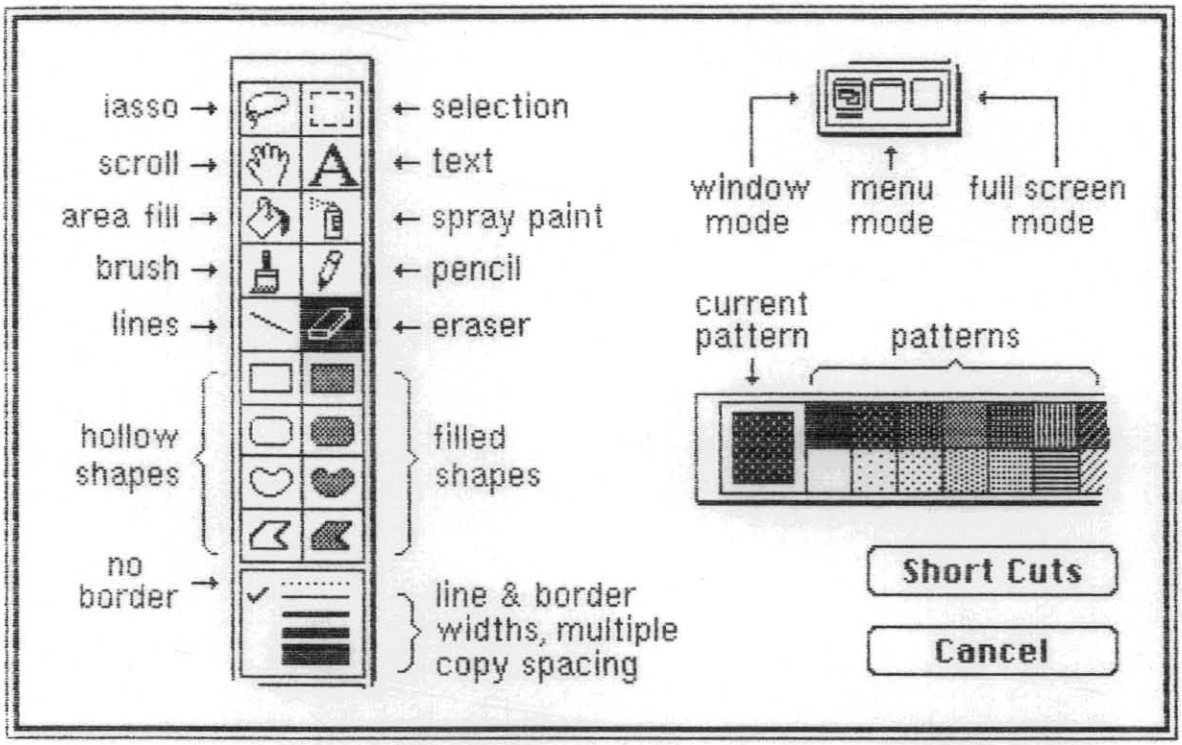

lasso →
scroll →
area fill →
brush →
lines →
← selection
← text
← spray paint
← pencil
← eraser
hollow shapes
filled shapes
no border →
line & border widths, multiple copy spacing
window mode
menu mode
full screen mode
current pattern
patterns
Short Cuts
Cancel

Diagram 28.

Hints in using *"Fullpaint"*

- If you make a mistake select *"undo"* from the *"edit"* menu to have another try.
- The painting can be moved about by using the "scroll bars" at the screen side and bottom, or by 'dragging' it with the "scroll hand".
- By selecting *"show pages..."* from the *"goodies"* menu the whole page (as printed) can be seen.
- The painting can be centred on the page by dragging it around in this mode.
- In the same way the portion of the page shown on the screen can be adjusted, in this mode, by 'dragging' the dotted rectangle around the page. (diag 29)
- Individual objects can moved around the screen by encircling them with the selection lasso,or rectangle, and 'dragging' them into position. This technique is very useful for positioning text. (diag 30)

Drawing in the triangular axes

- 'Click' on the bottom 'hollow shapes' symbol in the toolbox. This tool draws connecting lines between any points you 'click' on.
- Connect the centres of the circles defining the triangle using this tool.
- 'Click' on another tool, (eg. the pencil), to escape this mode.
- Now that the triangular axes are complete, the circles at each vertex of the triangle can be deleted.
- Using the pencil, 'click' on or near one of the circles, to select that area. (diag 31)
- Select *"fatbits"* from the *"goodies"* menu. This magnifies the selected area to a point where the individual pixels can be seen and manipulated.
- The pixels forming each circle can be deleted by 'clicking' on them, (diag 32), whilst additional pixels can be added to a point by 'clicking' there.
- 'Click' on the screen insert, (arrowed), to 'exit' from *"fatbits"*.

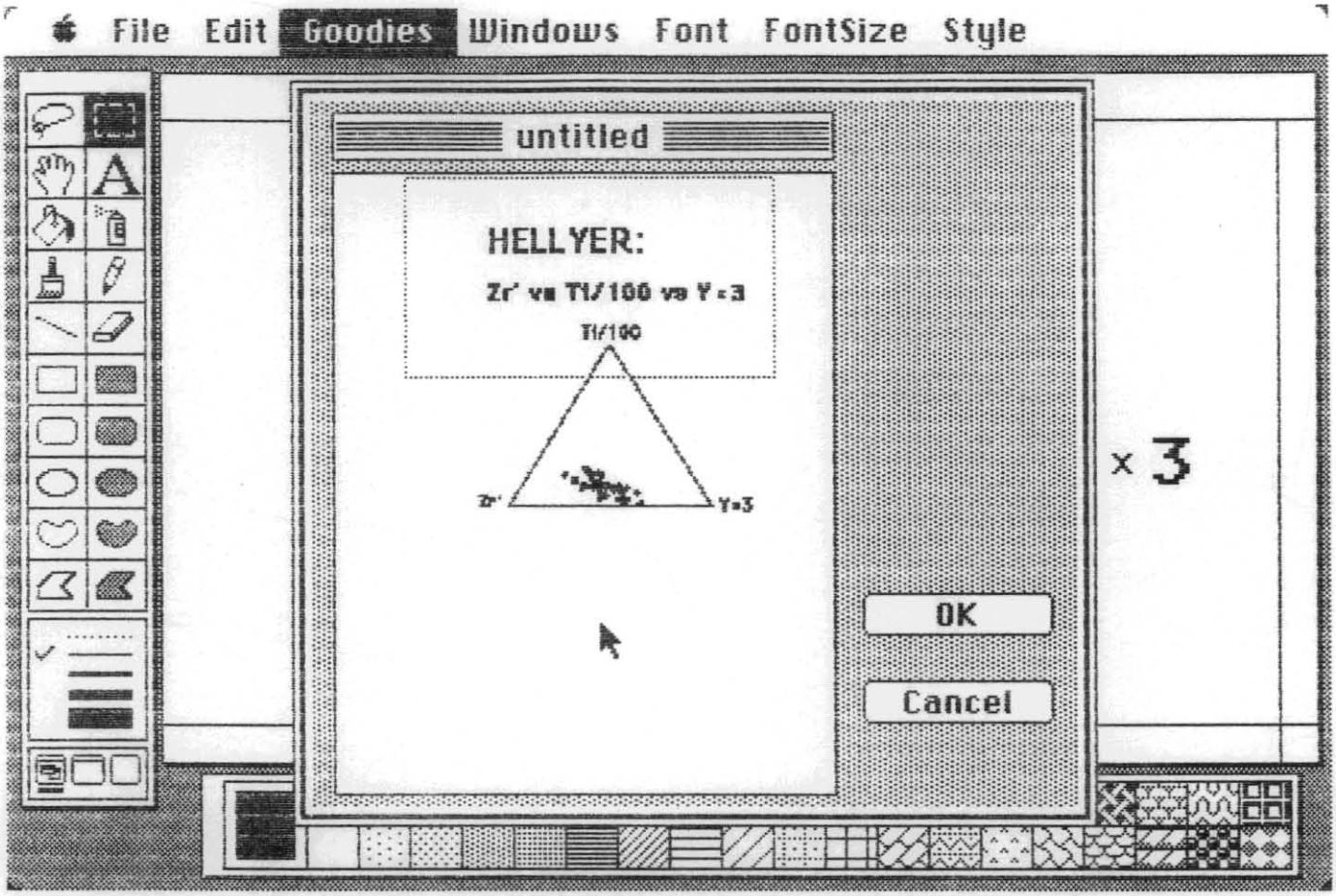

File Edit Goodies Windows Font FontSize Style
untitled
HELLYER:
Zr' vs Ti/100 vs Y x 3
Ti/100
Zr'
Y=3
x 3
OK
Cancel

Diagram 29.

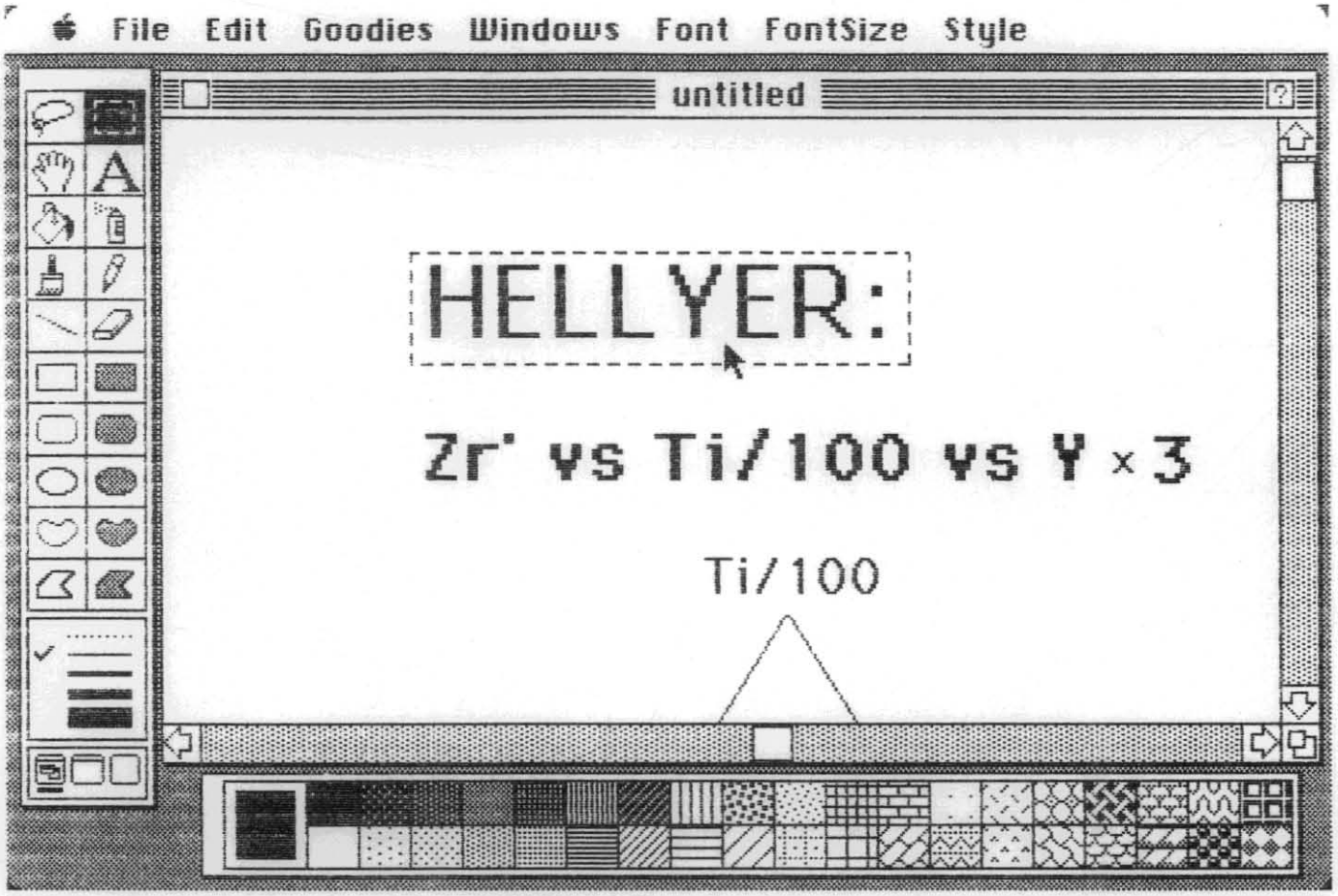

File Edit Goodies Windows Font FontSize Style
untitled
HELLYER:
Zr* vs Ti/100 vs Y x 3
Ti/100

Diagram 30.

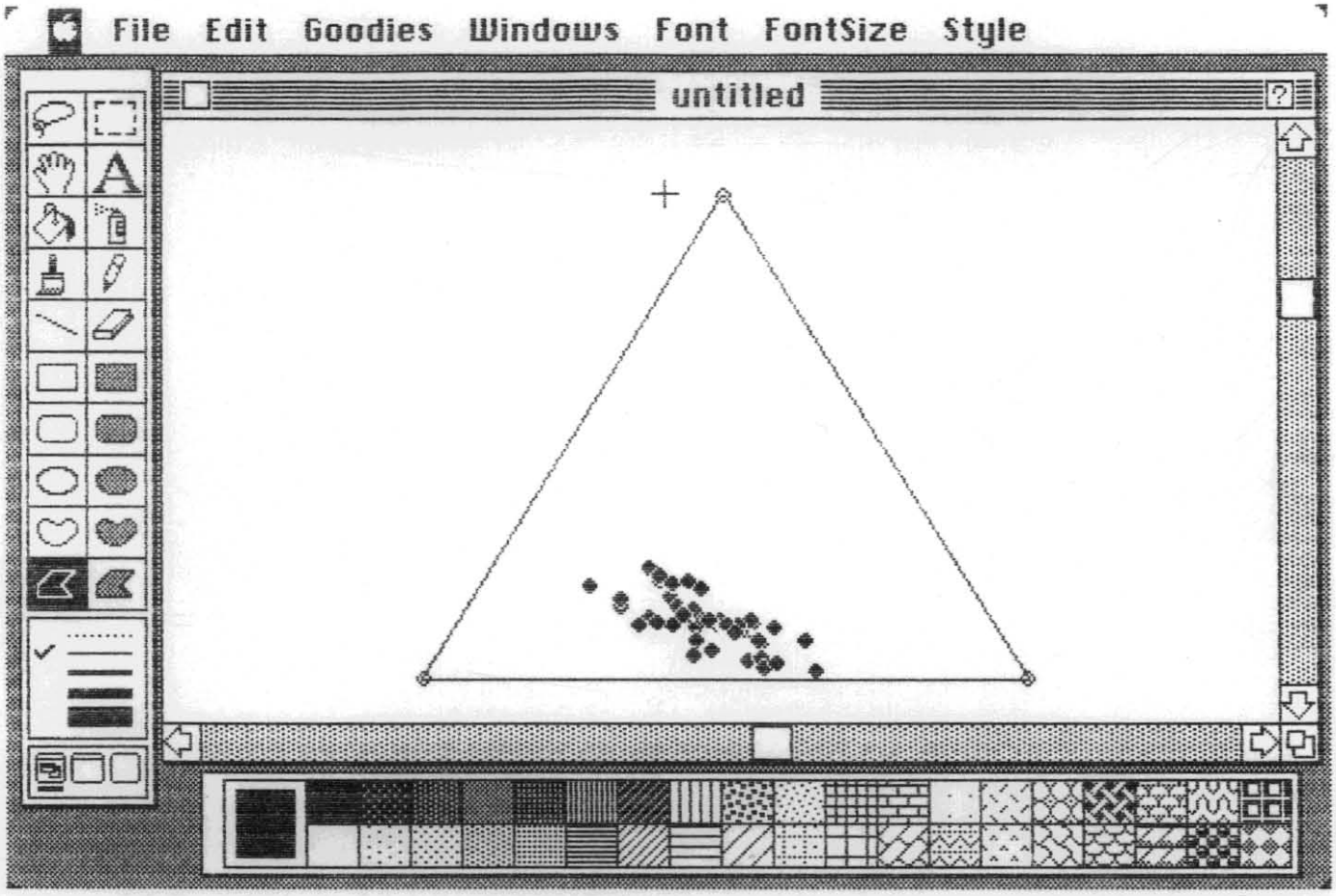


Diagram 31

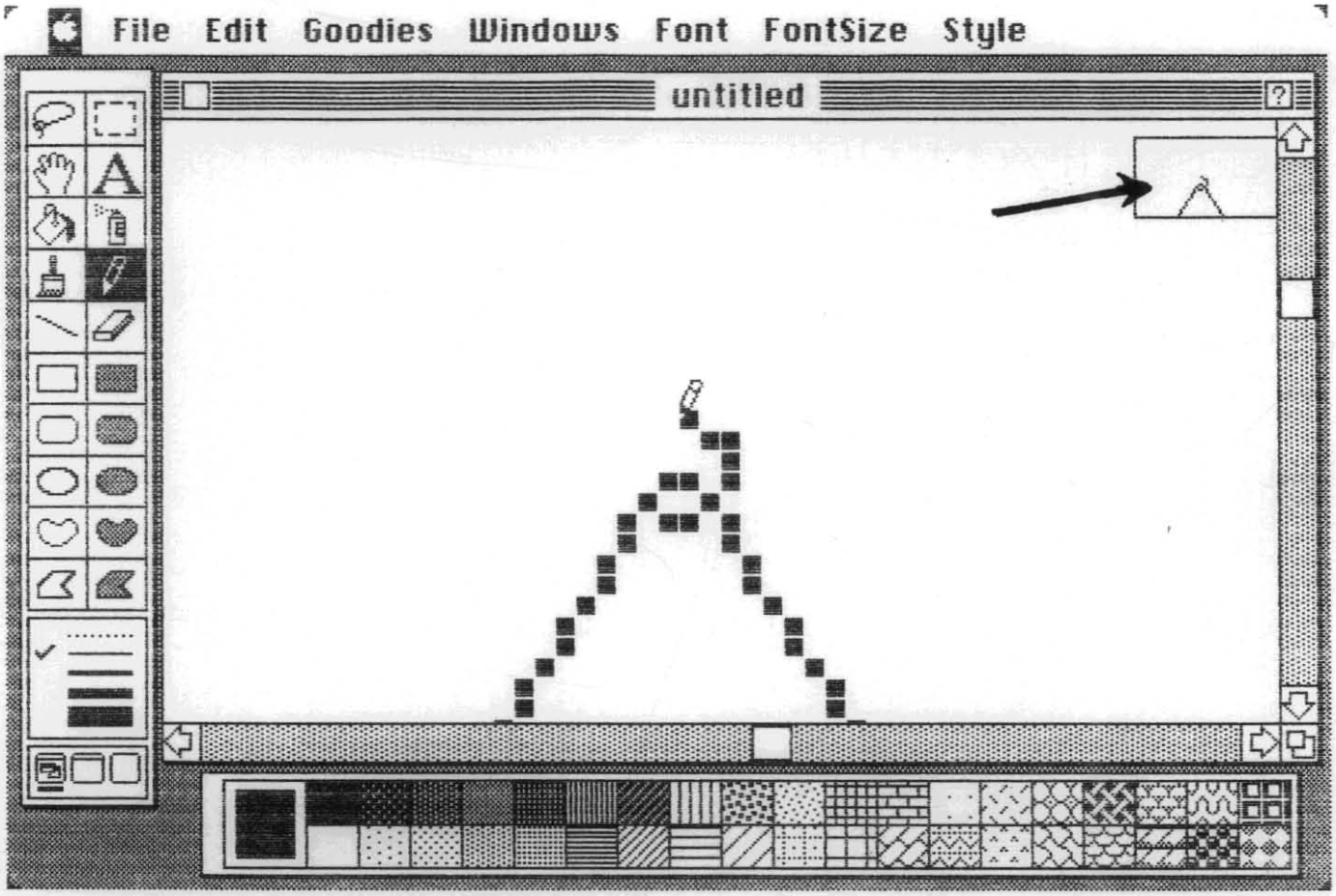


Diagram 32.

Adding text to the graph (diag 33)

- The graph can be titled and the axes labeled by selecting the text symbol, the letter A,from the tool box.
- *Font* and *Style* settings can then be made in the normal Mac way.
  (Eg. Bold 18 point Geneva - labelling
  Bold 24 & 36 point Geneva - title)
- 'Click' on the position where the text is to be placed. Type in the text, and enter it by 'clicking'.

Save the graph :

- By selecting *"Save as..."* from the *"file"* menu.
  Nb. Be sure to give the graph a different name from the Excel chart that it is based on.

Print the graph :

- By selecting *"print"* from the *"file"* menu.

Quitting *"fullpaint"*

- After saving the graph, if neccesary, 'click' on the 'close' box in the top left hand corner of the screen.
- Select *"quit"* from the *"file"* menu.
- Close all other open files.

HELLYER:

Zr* vs Ti/100 vs Y x 3

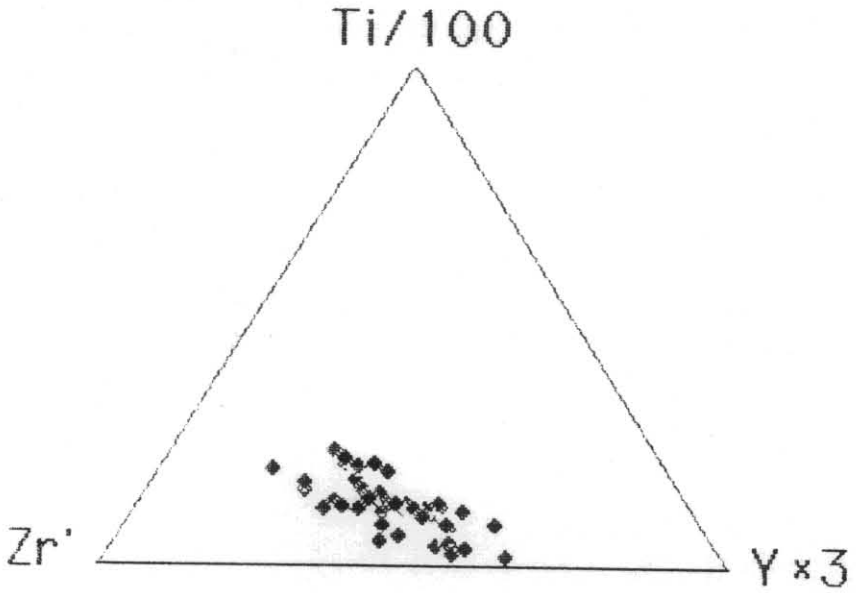


Diagram 33.