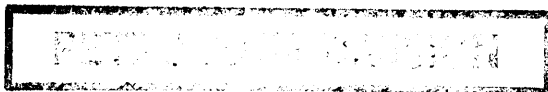


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**DETERMINATION OF ROCK-EVAL, ORGANIC  
CARBON AND KINETIC DATA OF SAMPLES  
FROM GIPPSLAND AND CARNARVON BASIN.  
AUSTRALIA.**

by

J.J. Links and J.E.A. Reinders

Sponsor: Shell Development  
Australia

FLOUNDER - 1

MORWONG - 1

PILOTFISH - 1

VOLADOR - 1

Investigation: 6BAS1061

**\*\*N.B. 3.5" & 5" disks held by EXL**

**'Input files for IBS123 Kinetic Data of**

**Gippsland & Carnarvon Basins, Australia'**

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KONINKLIJKE/SHELL EXPLORATIE EN PRODUKTIE LABORATORIUM

Shell Research B.V.

**SUMMARY**

*Rock-Eval, total organic carbon, and hydrocarbon generation kinetic measurements were done on samples from Gippsland Basin (Flounder-1, Morwong-1, Pilotfish-1, Volador-1) and Carnarvon Basin (Angel-1, Cape Range-2, North Ranking-1, Observation-1), Australia.*

**KEYWORDS**

Rock-Eval, total organic carbon, kinetics, Australia, Gippsland, Carnarvon.

## 1. INTRODUCTION

Rock-Eval and total organic carbon (TOC) measurements were done on fifteen source-rock samples from two basins. On suitable samples hydrocarbon generation kinetic measurements were done (see Table 1).

## 2. ROCK-EVAL AND TOC DATA

Rock-Eval and TOC results are shown in Table 2.

## 3. KINETIC DATA

Kinetic studies were done on samples with a hydrogen index above 100. Non-extracted samples were used. In the 'kin' column of Table 2 the number of kinetic runs on each sample is indicated. Isolated kerogen had to be used for the kinetic study of Pilotfish-1 (3040m) to obtain a sufficiently high signal amplitude. Kerogen was isolated through an acid treatment of the powdered rock sample. This reduced the amount of sample to such a degree that only one kinetic run could be performed. Because of technical problems the duplicate run on the sample Pilotfish-1 (3050 m) failed. Results are shown for each sample in the figures indicated in the 'fig' column of Table 2.

The kinetic data consist of two parts.

### I. ISOTHERMAL RATE DATA

The rate of hydrocarbon generation (fraction of pyrolysable kerogen that is converted into hydrocarbons per hour) at a single, elevated temperature in the laboratory (standardised to 340 °C) is expressed as a function of conversion. This is shown in parts A of the figures.

### II. ACTIVATION ENERGY DATA

A temperature stepping program is used to measure the generation rate at a number (typically 6) of different temperatures (between 260 °C and 350 °C). From these values the activation energies (E) are calculated and expressed again as a function of kerogen conversion. This is shown in parts B of the figures.

The extrapolation to any natural temperature history is performed within the basin modelling programs HEAT and TISA, and conversion is calculated as a function of temperature and time, or as a function of the vitrinite reflectance equivalent maturity (VR/E), which is calculated via the Modified Lopatin algorithm. Conversion versus VR/E

trends (shown in parts C of the figures) are virtually independent of the burial history. The reaction rate data (parts A) were used as input, as well as a linear relationship between activation energy and conversion (obtained from a least square fit of the data, as shown in parts B) and a hypothetical temperature history (temperature gradient: 3.3 °C/My, burial rate: 100 m/My, surface temperature: 15 °C). Listings of raw data are also available for direct input into IBS123 models (appendix A).

The temperature of maturation is measured to a precision of better than 0.5 °C. The estimated precision of the activation energies is ca 1 to 1.5 kcal/mol.

Because the experimental conditions include the transport of generated products in a helium gas flow at ca. 340 °C, the generation of hydrocarbons heavier than n-C35 will not be adequately modelled.

#### 4. FIGURES AND APPENDIX

For all figures the following applies:

- and □ apply to the first run (sample 1),
- - - - - and ● apply to the duplicate run (sample 2),
- - - - - represent extrapolated values.

The format for the IBS123 input files, given in appendix A, is as follows:

- line 1: comment line (names, depths, general remarks)
- line 2: number (N) of following lines with activation energies (E) and corresponding conversions (usually: N=2: E at conv. = 0 and conv. = 1).
- N lines: E(1) (cal/mol) conv(1)  
          ↓                  ↓  
          E(N) (cal/mol) conv(N)
- 1 line: temperature (°C) at which isothermal generation rate was measured.
- X lines 2 columns with conversion (fraction between 0 and 1) and corresponding rate values (1/s).

Table 1 sample information

basin	well	nr. of samples
Gippsland	Flounder-1	2
	Morwong-1	2
	Pilotfish-1	3
	Volador-1	2
Carnarvon	Angel-2	2
	Cape Range-2	1
	North Ranking-1	1
	Observation-1	2

Table 2 Rock-Eval, TOC and summary on kinetic measurements

name	depth	Tmax	S1	S2	S3	PI	TOC	HI	OI	kin	fig
Flounder-1	8800 ft	435	4.02	57.04	2.45	0.07	17.21	331	14	2	1
	8760 ft	433	1.48	35.35	3.69	0.04	18.73	188	19	2	2
Morwong-1	7860 ft	428	1.01	20.16	1.19	0.05	8.38	240	14	2	3
	7900 ft	431	0.32	8.73	3.11	0.04	10.70	81	29	-	
Pilotfish-1	3040 m	428	0.38	5.02	0.79	0.07	3.09	162	25	1*	4
	3050 m	425	6.79	67.54	1.56	0.09	17.51	385	8	1	5
	3085 m	430	2.25	1.57	2.22	0.59	3.65	43	60	-	
Volador-1	3573 m	433	3.41	43.39	1.91	0.07	15.36	282	12	2	6
	3552 m	427	3.09	51.57	1.29	0.06	17.24	299	7	2	7
Angel-2	10540 ft	425	11.63	49.74	0.99	0.19	13.90	357	7	2	8
	10630 ft	429	1.17	1.55	0.29	0.43	2.37	65	12	-	
Cape Range-2	5500 ft	433	0.66	0.84	2.01	0.44	1.02	82	197	-	
North Ranking-2	9190 ft	422	0.96	0.77	1.44	0.56	1.21	63	119	-	
Observation-1	7485 ft	422	2.50	0.44	1.50	0.85	0.79	55	189	-	
	7490 ft	428	0.99	0.43	1.07	0.70	0.99	43	108	-	

\* kinetic study done with isolated kerogen.

## 5. APPENDIX A: Input files for IBS123.

Australia - Gippsland Basin (Flounder-1 8800 ft); sample 1

2

50140. 0.0

55630. 1.0

340.

0.00000E+00	5.38713E-01	4.88495E-01	2.50000E-03
2.28094E-03	4.84000E-01	5.12415E-01	2.32147E-03
5.84523E-03	4.04513E-01	5.22750E-01	2.26105E-03
1.17718E-02	2.96123E-01	5.32726E-01	2.15453E-03
2.01969E-02	2.02792E-01	5.42204E-01	2.03507E-03
3.12773E-02	1.34990E-01	5.51178E-01	1.92527E-03
3.72791E-02	1.11789E-01	5.70559E-01	1.57323E-03
4.59801E-02	8.53508E-02	5.77600E-01	1.52104E-03
5.28421E-02	7.04524E-02	5.84382E-01	1.45639E-03
6.51632E-02	4.63775E-02	5.90886E-01	1.39587E-03
6.91214E-02	4.39241E-02	5.97102E-01	1.32743E-03
7.28458E-02	4.11297E-02	6.15856E-01	1.08465E-03
8.39832E-02	3.31580E-02	6.25441E-01	1.00638E-03
8.95357E-02	3.05069E-02	6.34391E-01	9.43087E-04
9.46624E-02	2.83591E-02	6.42719E-01	8.68641E-04
1.04677E-01	2.40104E-02	6.50428E-01	8.06268E-04
1.10742E-01	2.26054E-02	6.65415E-01	6.61273E-04
1.16433E-01	2.12120E-02	6.74169E-01	6.02079E-04
1.25625E-01	1.83933E-02	6.82186E-01	5.53437E-04
1.31807E-01	1.74438E-02	6.89552E-01	5.06925E-04
1.37640E-01	1.64283E-02	6.96317E-01	4.65853E-04
1.47363E-01	1.45234E-02	7.06963E-01	3.86737E-04
1.72209E-01	1.41302E-02	7.13852E-01	3.54195E-04
1.90162E-01	1.39011E-02	7.20142E-01	3.21631E-04
1.98737E-01	1.39658E-02	7.25867E-01	2.92938E-04
2.07231E-01	1.36503E-02	7.31079E-01	2.66000E-04
2.24450E-01	1.18127E-02	7.39596E-01	2.25934E-04
2.31660E-01	1.16620E-02	7.45581E-01	2.01038E-04
2.38711E-01	1.13005E-02	7.50902E-01	1.78281E-04
2.61348E-01	9.77809E-03	7.55674E-01	1.61565E-04
2.73050E-01	9.30947E-03	7.60003E-01	1.46589E-04
2.84192E-01	8.87567E-03	7.66604E-01	1.24740E-04
3.07096E-01	7.67824E-03	7.71591E-01	1.11461E-04
3.20750E-01	7.20456E-03	7.76024E-01	9.83634E-05
3.33525E-01	6.73036E-03	7.80000E-01	8.97081E-05
3.55082E-01	6.03694E-03	1.00000E+00	0.00000E+00
3.69298E-01	5.61418E-03		
3.82460E-01	5.18068E-03		
4.04528E-01	4.50669E-03		
4.20271E-01	4.11746E-03		
4.34673E-01	3.77852E-03		
4.56807E-01	3.22874E-03		
4.73498E-01	2.88365E-03		

Australia - Gippsland Basin (Flounder-1, 8800ft); sample 2.

2

50995. 0.0

56142. 1.0

340.

0.00000E+00	1.55997E+00	6.02747E-01	1.51583E-03
6.41047E-03	7.52941E-01	6.09652E-01	1.44847E-03
1.24191E-02	4.31425E-01	6.16251E-01	1.38190E-03
1.87590E-02	2.56904E-01	6.22525E-01	1.30646E-03
2.62526E-02	1.83625E-01	6.41457E-01	1.00725E-03
3.65851E-02	1.16642E-01	6.50500E-01	9.22598E-04
4.14597E-02	9.62766E-02	6.58828E-01	8.52334E-04
4.91751E-02	7.24704E-02	6.66472E-01	7.75034E-04
5.52291E-02	6.01665E-02	6.73444E-01	7.07725E-04
6.62804E-02	4.04865E-02	6.87484E-01	5.85625E-04
6.98709E-02	3.84817E-02	6.95279E-01	5.16082E-04
7.32569E-02	3.60522E-02	7.02296E-01	4.74566E-04
8.32832E-02	2.91496E-02	7.08693E-01	4.27630E-04
8.83957E-02	2.73119E-02	7.14429E-01	3.80595E-04
9.31423E-02	2.51717E-02	7.23659E-01	3.21698E-04
1.02443E-01	2.15448E-02	7.29302E-01	2.73367E-04
1.08094E-01	2.02555E-02	7.34212E-01	2.44013E-04
1.13387E-01	1.89448E-02	7.38745E-01	2.33371E-04
1.22131E-01	1.68324E-02	7.43000E-01	2.14331E-04
1.27999E-01	1.58752E-02	1.00000E+00	0.00000E+00
1.66141E-01	1.57014E-02		
1.76770E-01	1.44697E-02		
1.86762E-01	1.39030E-02		
2.06432E-01	1.25818E-02		
2.15026E-01	1.18443E-02		
2.23250E-01	1.15402E-02		
2.47529E-01	9.90878E-03		
2.61008E-01	9.27627E-03		
2.73571E-01	8.61364E-03		
2.97699E-01	7.60304E-03		
3.13527E-01	7.44277E-03		
3.28328E-01	6.63427E-03		
3.50506E-01	5.61302E-03		
3.65638E-01	5.19528E-03		
3.79607E-01	4.78695E-03		
4.02043E-01	4.07640E-03		
4.18436E-01	3.74334E-03		
4.33429E-01	3.41260E-03		
4.55722E-01	2.81950E-03		
4.72401E-01	2.49471E-03		
5.35198E-01	2.37875E-03		
5.45864E-01	2.24464E-03		
5.55978E-01	2.13263E-03		
5.65575E-01	2.01480E-03		
5.74654E-01	1.90354E-03		
5.95491E-01	1.60202E-03		



Australia - Gippsland Basin (Flounder-1, 8760ft); sample 1.

2

48822. 0.0

55956. 1.0

340.

0.00000E+00	1.31574E+00	6.07043E-01	1.64813E-03
7.68545E-03	6.81441E-01	6.14290E-01	1.54673E-03
1.49599E-02	4.24082E-01	6.21166E-01	1.48079E-03
2.25873E-02	2.73087E-01	6.35935E-01	1.23413E-03
3.25389E-02	1.82983E-01	6.41462E-01	1.18884E-03
4.50054E-02	1.40072E-01	6.46763E-01	1.13217E-03
5.21186E-02	1.12441E-01	6.51815E-01	1.07809E-03
6.29330E-02	8.77514E-02	6.56634E-01	1.02754E-03
7.16355E-02	7.38676E-02	6.71488E-01	8.39673E-04
8.81072E-02	5.14550E-02	6.78927E-01	7.78939E-04
9.34591E-02	4.87046E-02	6.85826E-01	7.20076E-04
9.85089E-02	4.59589E-02	6.92211E-01	6.65263E-04
1.13351E-01	3.66008E-02	6.98122E-01	6.15553E-04
1.20844E-01	3.41143E-02	7.09619E-01	4.97309E-04
1.27833E-01	3.19897E-02	7.16261E-01	4.58877E-04
1.41556E-01	2.68024E-02	7.22360E-01	4.17791E-04
1.49744E-01	2.51870E-02	7.27909E-01	3.79089E-04
1.57406E-01	2.35875E-02	7.32954E-01	3.44469E-04
1.70025E-01	2.09331E-02	7.40768E-01	2.77461E-04
1.78429E-01	1.94614E-02	7.45765E-01	2.58714E-04
1.86259E-01	1.82662E-02	7.50300E-01	2.27366E-04
1.99430E-01	1.59687E-02	7.54410E-01	2.12815E-04
2.09035E-01	1.51073E-02	7.58187E-01	1.91447E-04
2.52340E-01	1.52077E-02	7.63919E-01	1.36283E-04
2.72605E-01	1.48557E-02	7.67501E-01	1.18739E-04
2.81772E-01	1.48191E-02	7.70431E-01	8.97385E-05
2.90840E-01	1.45541E-02	7.72851E-01	8.24335E-05
3.11218E-01	1.29772E-02	7.75000E-01	7.03155E-05
3.19130E-01	1.27004E-02	1.00000E+00	0.00000E+00
3.26841E-01	1.23395E-02		
3.50908E-01	1.06704E-02		
3.63688E-01	1.01280E-02		
3.75773E-01	9.55645E-03		
3.99420E-01	8.17303E-03		
4.13898E-01	7.58666E-03		
4.27337E-01	7.05658E-03		
4.49050E-01	6.10193E-03		
4.63293E-01	5.56559E-03		
4.76066E-01	4.90748E-03		
5.10655E-01	3.61475E-03		
5.23559E-01	3.46168E-03		
5.43545E-01	2.87401E-03		
5.58120E-01	2.46658E-03		
5.72178E-01	1.95739E-03		
5.91525E-01	1.77314E-03		
5.99419E-01	1.71823E-03		

Australia - Gippsland Basin (Flounder-1, 8760ft); sample 2

2

49221. 0.0

55888. 1.0

340.

0.00000E+00	1.30798E+00	6.46233E-01	8.66013E-04
7.16830E-03	7.33258E-01	6.54902E-01	7.88752E-04
1.36872E-02	4.50635E-01	6.62815E-01	7.19072E-04
2.23245E-02	3.01321E-01	6.70097E-01	6.66307E-04
3.30246E-02	1.98414E-01	6.84208E-01	5.27119E-04
4.67009E-02	1.46216E-01	6.92137E-01	4.74048E-04
5.29285E-02	1.33718E-01	6.99238E-01	4.21180E-04
6.45296E-02	1.01547E-01	7.05590E-01	3.78578E-04
7.36576E-02	8.41846E-02	7.11389E-01	3.50467E-04
9.15712E-02	5.87449E-02	7.20543E-01	2.88095E-04
9.70932E-02	5.45105E-02	7.26346E-01	2.57441E-04
1.02237E-01	5.11751E-02	7.31509E-01	2.27462E-04
1.18062E-01	4.09366E-02	7.36156E-01	2.08442E-04
1.25673E-01	3.77876E-02	7.40393E-01	1.88683E-04
1.32691E-01	3.49680E-02	7.47008E-01	1.43879E-04
1.46788E-01	2.93311E-02	7.51352E-01	1.26895E-04
1.54929E-01	2.73125E-02	7.55109E-01	1.07148E-04
1.62507E-01	2.55421E-02	7.58332E-01	9.34896E-05
1.74950E-01	2.22907E-02	7.61125E-01	8.02506E-05
1.83154E-01	2.08972E-02	7.65000E-01	5.91332E-05
2.22547E-01	2.08281E-02	1.00000E+00	0.00000E+00
2.53391E-01	1.92272E-02		
2.66814E-01	1.86379E-02		
2.79786E-01	1.79759E-02		
3.08135E-01	1.53946E-02		
3.18805E-01	1.47774E-02		
3.29071E-01	1.42657E-02		
3.59967E-01	1.16160E-02		
3.75782E-01	1.07983E-02		
3.90484E-01	1.00523E-02		
4.18970E-01	8.45523E-03		
4.35961E-01	7.64156E-03		
4.51381E-01	6.97814E-03		
4.75635E-01	5.95149E-03		
4.91648E-01	5.45550E-03		
5.21658E-01	2.44426E-03		
5.33819E-01	2.31732E-03		
5.45333E-01	2.17997E-03		
5.56183E-01	2.04788E-03		
5.66374E-01	1.91481E-03		
5.88334E-01	1.53171E-03		
5.96062E-01	1.45409E-03		
6.03404E-01	1.37803E-03		
6.10374E-01	1.30701E-03		
6.16997E-01	1.24056E-03		
6.36720E-01	9.53104E-04		

## Australia - Gippsland Basin (Morwong-1, 7860ft); sample 1.

2

50983. 0.0

55468. 1.0

340.

0.00000E+00	1.68984E+00	6.69329E-01	1.78072E-03
8.28060E-03	8.69801E-01	6.86488E-01	1.44468E-03
1.52534E-02	5.04108E-01	6.92651E-01	1.38893E-03
2.40573E-02	3.26910E-01	6.98560E-01	1.32648E-03
3.41005E-02	2.33278E-01	7.04211E-01	1.26795E-03
4.79755E-02	1.64832E-01	7.09611E-01	1.21001E-03
5.43284E-02	1.37023E-01	7.26461E-01	9.96272E-04
6.52734E-02	1.15236E-01	7.34814E-01	9.14574E-04
7.50586E-02	8.92511E-02	7.42492E-01	8.40078E-04
9.25225E-02	6.50602E-02	7.49560E-01	7.73869E-04
9.83312E-02	6.18177E-02	7.56103E-01	7.18914E-04
1.03893E-01	5.74528E-02	7.68894E-01	5.76712E-04
1.20188E-01	4.70948E-02	7.76159E-01	5.25560E-04
1.28491E-01	4.55146E-02	7.82729E-01	4.70507E-04
1.36512E-01	4.14723E-02	7.88687E-01	4.32147E-04
1.51991E-01	3.46771E-02	7.94108E-01	3.88441E-04
1.69779E-01	3.10607E-02	8.02673E-01	3.19515E-04
1.83832E-01	2.63765E-02	8.08026E-01	2.87263E-04
1.92545E-01	2.61647E-02	8.12882E-01	2.62726E-04
2.01469E-01	2.37401E-02	8.17310E-01	2.38602E-04
2.16209E-01	1.98399E-02	8.21357E-01	2.19365E-04
2.34347E-01	1.78649E-02	8.27721E-01	1.67565E-04
2.60552E-01	1.29169E-02	8.31832E-01	1.42144E-04
3.06662E-01	1.29135E-02	8.35455E-01	1.30630E-04
3.24127E-01	1.14732E-02	8.38687E-01	1.12708E-04
3.58115E-01	1.06738E-02	8.41502E-01	9.90861E-05
3.65596E-01	1.06656E-02	8.45487E-01	7.28139E-05
3.72985E-01	1.04169E-02	8.48000E-01	5.31758E-05
3.94821E-01	8.87939E-03	1.00000E+00	0.00000E+00
4.07112E-01	8.67250E-03		
4.19026E-01	8.34581E-03		
4.41918E-01	7.15985E-03		
4.56425E-01	6.67005E-03		
4.69826E-01	6.11119E-03		
4.91017E-01	5.46583E-03		
5.05621E-01	4.99229E-03		
5.18891E-01	4.51401E-03		
5.53737E-01	3.04385E-03		
5.66305E-01	2.96692E-03		
5.86118E-01	2.63187E-03		
6.01710E-01	2.34469E-03		
6.14951E-01	2.10418E-03		
6.35694E-01	2.05736E-03		
6.44521E-01	2.02599E-03		
6.53136E-01	1.95532E-03		
6.61418E-01	1.86784E-03		

## Australia - Gippsland Basin (Morwong-1, 7860ft); sample 2.

2

50548. 0.0

55263. 1.0

340.

0.00000E+00	1.39434E+00	6.06607E-01	2.01518E-03
6.64591E-03	7.83310E-01	6.15077E-01	1.94841E-03
1.29898E-02	4.65667E-01	6.23215E-01	1.85645E-03
2.06366E-02	2.88179E-01	6.30969E-01	1.76473E-03
3.15177E-02	2.49289E-01	6.38329E-01	1.66927E-03
4.59986E-02	1.33078E-01	6.55683E-01	1.34738E-03
5.15737E-02	1.12901E-01	6.61358E-01	1.29248E-03
6.16556E-02	8.75864E-02	6.66797E-01	1.23538E-03
6.97377E-02	7.34535E-02	6.71989E-01	1.17660E-03
8.45144E-02	5.15865E-02	6.76937E-01	1.12010E-03
8.94978E-02	4.81678E-02	6.92728E-01	8.74718E-04
9.41626E-02	4.53064E-02	6.99992E-01	8.06638E-04
1.07904E-01	3.63068E-02	7.06693E-01	7.42783E-04
1.14855E-01	3.36237E-02	7.12860E-01	6.82166E-04
1.21307E-01	3.13858E-02	7.18527E-01	6.26219E-04
1.34016E-01	2.70616E-02	7.30114E-01	5.08528E-04
1.41777E-01	2.52853E-02	7.36414E-01	4.59027E-04
1.49027E-01	2.36963E-02	7.42131E-01	4.18142E-04
1.60914E-01	2.10089E-02	7.47340E-01	3.80742E-04
1.68915E-01	1.97037E-02	7.52103E-01	3.49051E-04
1.76419E-01	1.85410E-02	7.60057E-01	2.94243E-04
1.89012E-01	1.63177E-02	7.64943E-01	2.66499E-04
1.98240E-01	1.51741E-02	7.69384E-01	2.42730E-04
2.06848E-01	1.42610E-02	7.73460E-01	2.24416E-04
2.20467E-01	1.25900E-02	7.77207E-01	2.04807E-04
2.31051E-01	1.16559E-02	7.83506E-01	1.71822E-04
2.79735E-01	1.09740E-02	7.87814E-01	1.56708E-04
2.96123E-01	1.05977E-02	7.91755E-01	1.43762E-04
3.12154E-01	1.04938E-02	7.95386E-01	1.32895E-04
3.28718E-01	9.44176E-03	7.98739E-01	1.22455E-04
3.35779E-01	9.26140E-03	8.04068E-01	1.04996E-04
3.42687E-01	9.03914E-03	8.08000E-01	9.44072E-05
3.63169E-01	7.86977E-03	1.00000E+00	0.00000E+00
3.74704E-01	7.42128E-03		
3.85584E-01	7.00497E-03		
4.05998E-01	6.01370E-03		
4.19120E-01	5.59554E-03		
4.31327E-01	5.20787E-03		
4.50275E-01	4.47001E-03		
4.63214E-01	4.12466E-03		
4.75176E-01	3.82431E-03		
4.94221E-01	3.22865E-03		
5.08091E-01	2.92048E-03		
5.20651E-01	2.64993E-03		
5.39291E-01	2.22421E-03		
5.84663E-01	2.11746E-03		

Australia - Gippsland Basin (Pilotfish-1, 3040 m); sample 1.

2

49670. 0.0

56177. 1.0

340.

0.00000E+00	2.79844E+00	6.92910E-01	1.28643E-03
1.55067E-02	1.78671E+00	7.02930E-01	1.17023E-03
3.08914E-02	1.02639E+00	7.12087E-01	1.07139E-03
4.79023E-02	5.99459E-01	7.20472E-01	9.77946E-04
6.63608E-02	3.64864E-01	7.28235E-01	9.16939E-04
8.83368E-02	2.60609E-01	7.43657E-01	7.20356E-04
9.73033E-02	2.24097E-01	7.52080E-01	6.44824E-04
1.13154E-01	1.62913E-01	7.59589E-01	5.70574E-04
1.25167E-01	1.31777E-01	7.66304E-01	5.15072E-04
1.48743E-01	8.76089E-02	7.72452E-01	4.77721E-04
1.55557E-01	8.13544E-02	7.82363E-01	3.83245E-04
1.61875E-01	7.56754E-02	7.88298E-01	3.33733E-04
1.81627E-01	5.89566E-02	7.93540E-01	2.98857E-04
1.90624E-01	5.38310E-02	7.98273E-01	2.71888E-04
1.98815E-01	4.91311E-02	8.02561E-01	2.44751E-04
2.15315E-01	4.02305E-02	8.09149E-01	1.76548E-04
2.24471E-01	3.71269E-02	8.13379E-01	1.62580E-04
2.32889E-01	3.41969E-02	8.17043E-01	1.30975E-04
2.46856E-01	2.93136E-02	8.20009E-01	1.06604E-04
2.55723E-01	2.74479E-02	8.22525E-01	9.47811E-05
2.64040E-01	2.59416E-02	8.26000E-01	6.30142E-05
2.97492E-01	2.25642E-02	1.00000E+00	0.00000E+00
3.25338E-01	2.09357E-02		
3.37938E-01	2.02513E-02		
3.50049E-01	1.93707E-02		
3.74714E-01	1.65313E-02		
3.84614E-01	1.59267E-02		
3.94141E-01	1.53276E-02		
4.22378E-01	1.25216E-02		
4.37058E-01	1.16183E-02		
4.50710E-01	1.08510E-02		
4.77110E-01	9.24195E-03		
4.93126E-01	8.37550E-03		
5.07688E-01	7.65858E-03		
5.30457E-01	6.57462E-03		
5.45712E-01	6.05206E-03		
5.76159E-01	3.02262E-03		
5.87968E-01	2.88256E-03		
5.99214E-01	2.72989E-03		
6.09860E-01	2.57364E-03		
6.19894E-01	2.41597E-03		
6.42210E-01	2.01139E-03		
6.50140E-01	1.91152E-03		
6.57691E-01	1.81856E-03		
6.64888E-01	1.73240E-03		
6.71756E-01	1.65217E-03		

Australia - Gippsland Basin (Pilotfish-1, 3050 m); sample 1.

2

50252. 0.0

52677. 1.0

340.

0.00000E+00	2.33747E+00	6.17269E-01	2.23033E-03
8.70884E-03	1.19112E+00	6.25524E-01	2.08317E-03
1.73128E-02	7.12432E-01	6.43594E-01	1.66086E-03
2.71847E-02	4.32873E-01	6.49830E-01	1.59248E-03
3.81522E-02	2.90224E-01	6.55766E-01	1.50332E-03
5.27085E-02	1.83932E-01	6.61397E-01	1.43256E-03
5.91347E-02	1.50571E-01	6.66736E-01	1.34957E-03
6.98955E-02	1.12953E-01	6.83293E-01	1.06592E-03
7.82984E-02	9.30737E-02	6.91153E-01	9.79335E-04
9.35015E-02	6.50807E-02	6.98403E-01	9.06034E-04
9.86562E-02	6.16475E-02	7.05078E-01	8.29302E-04
1.03519E-01	5.79651E-02	7.11220E-01	7.66692E-04
1.17757E-01	4.57722E-02	7.23393E-01	6.26017E-04
1.24895E-01	4.22389E-02	7.30277E-01	5.65067E-04
1.31503E-01	3.92965E-02	7.36499E-01	5.11103E-04
1.44461E-01	3.36367E-02	7.42149E-01	4.65861E-04
1.52338E-01	3.13172E-02	7.47325E-01	4.28624E-04
1.59698E-01	2.94339E-02	7.55731E-01	3.53600E-04
1.71647E-01	2.54231E-02	7.60923E-01	3.18848E-04
1.79530E-01	2.34939E-02	7.65608E-01	2.87731E-04
1.86899E-01	2.22715E-02	7.69878E-01	2.65007E-04
1.99234E-01	1.93020E-02	7.73821E-01	2.45231E-04
2.08208E-01	1.79475E-02	7.80300E-01	1.97114E-04
2.16614E-01	1.69842E-02	7.84675E-01	1.80027E-04
2.29943E-01	1.49168E-02	7.88632E-01	1.61065E-04
2.40308E-01	1.38742E-02	7.92130E-01	1.40317E-04
2.49915E-01	1.28436E-02	7.95227E-01	1.26554E-04
3.18669E-01	1.22858E-02	8.00000E-01	1.07226E-04
3.26196E-01	1.21348E-02	1.00000E+00	0.00000E+00
3.33529E-01	1.16630E-02		
3.55101E-01	9.94871E-03		
3.66978E-01	9.33573E-03		
3.78112E-01	8.74760E-03		
3.99291E-01	7.59885E-03		
4.12906E-01	7.15423E-03		
4.25573E-01	6.57572E-03		
4.44883E-01	5.69215E-03		
4.58327E-01	5.24524E-03		
4.70684E-01	4.81085E-03		
4.90180E-01	3.99380E-03		
5.04278E-01	3.66036E-03		
5.17136E-01	3.32277E-03		
5.36355E-01	2.82543E-03		
5.89065E-01	2.68297E-03		
5.99039E-01	2.53774E-03		
6.08445E-01	2.38319E-03		

Australia - Gippsland Basin (Volador-1, 3573 m); sample 1.

2

49738. 0.0

55005. 1.0

340.

0.00000E+00	1.56214E+00	5.50023E-01	2.17518E-03
6.47003E-03	8.09610E-01	5.59618E-01	2.11763E-03
1.22920E-02	4.72983E-01	5.68868E-01	2.01541E-03
1.92832E-02	2.61593E-01	5.77728E-01	1.93782E-03
2.71763E-02	1.64003E-01	5.86094E-01	1.79047E-03
3.67876E-02	1.09004E-01	6.03744E-01	1.44032E-03
4.09937E-02	9.39843E-02	6.10127E-01	1.39345E-03
4.84577E-02	7.19434E-02	6.16291E-01	1.34028E-03
5.43875E-02	6.01094E-02	6.22205E-01	1.28069E-03
6.52106E-02	4.13586E-02	6.27860E-01	1.22277E-03
6.88585E-02	4.02052E-02	6.44933E-01	9.84091E-04
7.23561E-02	3.80706E-02	6.53523E-01	9.10639E-04
8.29290E-02	3.12303E-02	6.61464E-01	8.38793E-04
8.83182E-02	2.93028E-02	6.68817E-01	7.79193E-04
9.33749E-02	2.75716E-02	6.75644E-01	7.21503E-04
1.03424E-01	2.38994E-02	6.88922E-01	5.88430E-04
1.09615E-01	2.27029E-02	6.96610E-01	5.34813E-04
1.15452E-01	2.13106E-02	7.03606E-01	4.86134E-04
1.25073E-01	1.89889E-02	7.10004E-01	4.46653E-04
1.31599E-01	1.80595E-02	7.15900E-01	4.12032E-04
1.37819E-01	1.73169E-02	7.25023E-01	3.40776E-04
1.48395E-01	1.51257E-02	7.30974E-01	3.07791E-04
1.56135E-01	1.43491E-02	7.36393E-01	2.82374E-04
1.63469E-01	1.36313E-02	7.41369E-01	2.59103E-04
1.92936E-01	1.33465E-02	7.45937E-01	2.37662E-04
2.18828E-01	1.27719E-02	7.53320E-01	1.97076E-04
2.27163E-01	1.24249E-02	7.58508E-01	1.78337E-04
2.43848E-01	1.07217E-02	7.63239E-01	1.63735E-04
2.50932E-01	1.07136E-02	7.67493E-01	1.43656E-04
2.57924E-01	1.04501E-02	7.71283E-01	1.30002E-04
2.78688E-01	9.14043E-03	7.77000E-01	1.09873E-04
2.90459E-01	8.69671E-03	1.00000E+00	0.00000E+00
3.01645E-01	8.26291E-03		
3.23205E-01	7.31261E-03		
3.37222E-01	6.87601E-03		
3.50347E-01	6.41664E-03		
3.70842E-01	5.63688E-03		
3.85194E-01	5.28105E-03		
3.98628E-01	4.94427E-03		
4.20297E-01	4.21285E-03		
4.36204E-01	3.87115E-03		
4.50860E-01	3.58243E-03		
4.72967E-01	3.02949E-03		
4.89982E-01	2.74867E-03		
5.05238E-01	2.43550E-03		
5.27455E-01	2.28412E-03		

Australia - Gippsland Basin (Volador-1, 3573 m); sample 2.

2

49738. 0.0

55005. 1.0

340.

0.00000E+00	1.56214E+00	5.50023E-01	2.17518E-03
6.47003E-03	8.09610E-01	5.59618E-01	2.11763E-03
1.22920E-02	4.72983E-01	5.68868E-01	2.01541E-03
1.92832E-02	2.61593E-01	5.77728E-01	1.93782E-03
2.71763E-02	1.64003E-01	5.86094E-01	1.79047E-03
3.67876E-02	1.09004E-01	6.03744E-01	1.44032E-03
4.09937E-02	9.39843E-02	6.10127E-01	1.39345E-03
4.84577E-02	7.19434E-02	6.16291E-01	1.34028E-03
5.43875E-02	6.01094E-02	6.22205E-01	1.28069E-03
6.52106E-02	4.13586E-02	6.27860E-01	1.22277E-03
6.88585E-02	4.02052E-02	6.44933E-01	9.84091E-04
7.23561E-02	3.80706E-02	6.53523E-01	9.10639E-04
8.29290E-02	3.12303E-02	6.61464E-01	8.38793E-04
8.83182E-02	2.93028E-02	6.68817E-01	7.79193E-04
9.33749E-02	2.75716E-02	6.75644E-01	7.21503E-04
1.03424E-01	2.38994E-02	6.88922E-01	5.88430E-04
1.09615E-01	2.27029E-02	6.96610E-01	5.34813E-04
1.15452E-01	2.13106E-02	7.03606E-01	4.86134E-04
1.25073E-01	1.89889E-02	7.10004E-01	4.46653E-04
1.31599E-01	1.80595E-02	7.15900E-01	4.12032E-04
1.37819E-01	1.73169E-02	7.25023E-01	3.40776E-04
1.48395E-01	1.51257E-02	7.30974E-01	3.07791E-04
1.56135E-01	1.43491E-02	7.36393E-01	2.82374E-04
1.63469E-01	1.36313E-02	7.41369E-01	2.59103E-04
1.92936E-01	1.33465E-02	7.45937E-01	2.37662E-04
2.18828E-01	1.27719E-02	7.53320E-01	1.97076E-04
2.27163E-01	1.24249E-02	7.58508E-01	1.78337E-04
2.43848E-01	1.07217E-02	7.63239E-01	1.63735E-04
2.50932E-01	1.07136E-02	7.67493E-01	1.43656E-04
2.57924E-01	1.04501E-02	7.71283E-01	1.30002E-04
2.78688E-01	9.14043E-03	7.77000E-01	1.09873E-04
2.90459E-01	8.69671E-03	1.00000E+00	0.00000E+00
3.01645E-01	8.26291E-03		
3.23205E-01	7.31261E-03		
3.37222E-01	6.87601E-03		
3.50347E-01	6.41664E-03		
3.70842E-01	5.63688E-03		
3.85194E-01	5.28105E-03		
3.98628E-01	4.94427E-03		
4.20297E-01	4.21285E-03		
4.36204E-01	3.87115E-03		
4.50860E-01	3.58243E-03		
4.72967E-01	3.02949E-03		
4.89982E-01	2.74867E-03		
5.05238E-01	2.43550E-03		
5.27455E-01	2.28412E-03		



Australia - Gippsland Basin (Volador-1, 3552 m); sample 1.

2

52381. 0.0

54420. 1.0

340.

0.00000E+00	1.87607E+00	5.50252E-01	2.17887E-03
8.59539E-03	9.59224E-01	5.59337E-01	2.06322E-03
1.59846E-02	5.93115E-01	5.67942E-01	1.95261E-03
2.47271E-02	3.69666E-01	5.87390E-01	1.56285E-03
3.56928E-02	2.34697E-01	5.93961E-01	1.49909E-03
4.86573E-02	1.65893E-01	6.00261E-01	1.43552E-03
5.55804E-02	1.37134E-01	6.06260E-01	1.35818E-03
6.59228E-02	1.02978E-01	6.11970E-01	1.29969E-03
7.40042E-02	8.48127E-02	6.29852E-01	1.04381E-03
8.88608E-02	5.68137E-02	6.38504E-01	9.67207E-04
9.36087E-02	5.37427E-02	6.46459E-01	8.81138E-04
9.80793E-02	5.04014E-02	6.53759E-01	8.14026E-04
1.11466E-01	3.95381E-02	6.60484E-01	7.47118E-04
1.18004E-01	3.67485E-02	6.73709E-01	5.98722E-04
1.24102E-01	3.44520E-02	6.81088E-01	5.41959E-04
1.36253E-01	2.85154E-02	6.87778E-01	4.91880E-04
1.43317E-01	2.65676E-02	6.93842E-01	4.44871E-04
1.49890E-01	2.47142E-02	6.99367E-01	4.08196E-04
1.60726E-01	2.15270E-02	7.08317E-01	3.35906E-04
1.67858E-01	2.02795E-02	7.13805E-01	2.99296E-04
1.74524E-01	1.88221E-02	7.18754E-01	2.73243E-04
1.85908E-01	1.67752E-02	7.23239E-01	2.45478E-04
1.94181E-01	1.56322E-02	7.27291E-01	2.23097E-04
2.01839E-01	1.43922E-02	7.33948E-01	1.83494E-04
2.13832E-01	1.24998E-02	7.38366E-01	1.56888E-04
2.27749E-01	1.23298E-02	7.42273E-01	1.44030E-04
2.51213E-01	1.16734E-02	7.45806E-01	1.28048E-04
2.58790E-01	1.16025E-02	7.49000E-01	1.17885E-04
2.75005E-01	1.02486E-02	1.00000e+00	0.00000e+00
2.81651E-01	1.01757E-02		
2.88201E-01	9.95543E-03		
3.08174E-01	8.70628E-03		
3.19273E-01	8.35772E-03		
3.29870E-01	7.93816E-03		
3.50354E-01	6.81904E-03		
3.63126E-01	6.28087E-03		
3.75024E-01	5.92614E-03		
3.93962E-01	5.11557E-03		
4.06792E-01	4.76105E-03		
4.18628E-01	4.35244E-03		
4.37469E-01	3.60979E-03		
4.50870E-01	3.27260E-03		
4.63173E-01	3.04772E-03		
5.07785E-01	2.38109E-03		
5.30845E-01	2.33003E-03		
5.40707E-01	2.27993E-03		

Australia - Gippsland Basin (Volador-1, 3552 m); sample 2

2  
51733. 0.0  
55473. 1.0

340.

0.00000E+00	1.52288E+00	7.46311E-01	1.54939E-04
6.37848E-03	8.58945E-01	7.49992E-01	1.43383E-04
1.35197E-02	4.75927E-01	7.53422E-01	1.34583E-04
2.05064E-02	3.08657E-01	7.58000E-01	7.74882E-05
2.95507E-02	1.99867E-01	1.00000E+00	0.00000E+00
4.03092E-02	1.46396E-01		
4.65450E-02	1.14178E-01		
5.52728E-02	8.30093E-02		
6.19215E-02	6.74174E-02		
7.42569E-02	4.62046E-02		
7.81792E-02	4.28130E-02		
8.18376E-02	4.02741E-02		
9.28160E-02	3.06390E-02		
9.79841E-02	2.82051E-02		
1.02746E-01	2.60645E-02		
1.12161E-01	2.23181E-02		
1.17798E-01	2.06222E-02		
1.22853E-01	1.79086E-02		
1.56210E-01	1.75468E-02		
2.92989E-01	1.35813E-02		
3.40800E-01	1.06690E-02		
3.79222E-01	8.73569E-03		
4.11140E-01	7.32902E-03		
4.38256E-01	6.27918E-03		
4.90370E-01	4.27259E-03		
5.06860E-01	3.94367E-03		
5.21980E-01	3.57785E-03		
5.35812E-01	3.29335E-03		
5.48511E-01	3.00718E-03		
5.84013E-01	2.08776E-03		
5.99900E-01	1.83454E-03		
6.14001E-01	1.64153E-03		
6.26621E-01	1.46526E-03		
6.37905E-01	1.30971E-03		
6.58612E-01	9.70402E-04		
6.69722E-01	8.45390E-04		
6.79514E-01	7.53234E-04		
6.88195E-01	6.62921E-04		
6.95950E-01	6.01096E-04		
7.07984E-01	4.65787E-04		
7.15147E-01	4.08288E-04		
7.21537E-01	3.70827E-04		
7.27320E-01	3.33858E-04		
7.32422E-01	2.87564E-04		
7.40214E-01	2.16949E-04		
7.43644E-01	6.12578E-05		

Australia Flounder-1, 8800ft

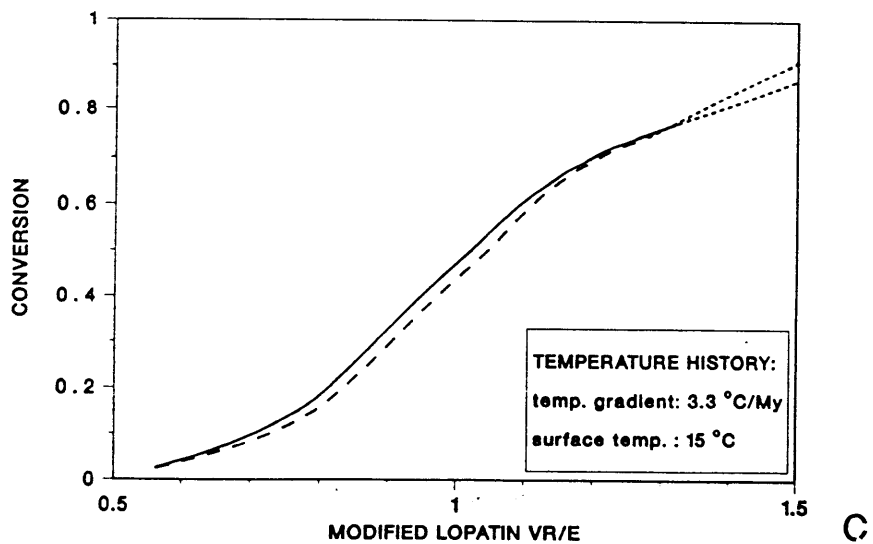
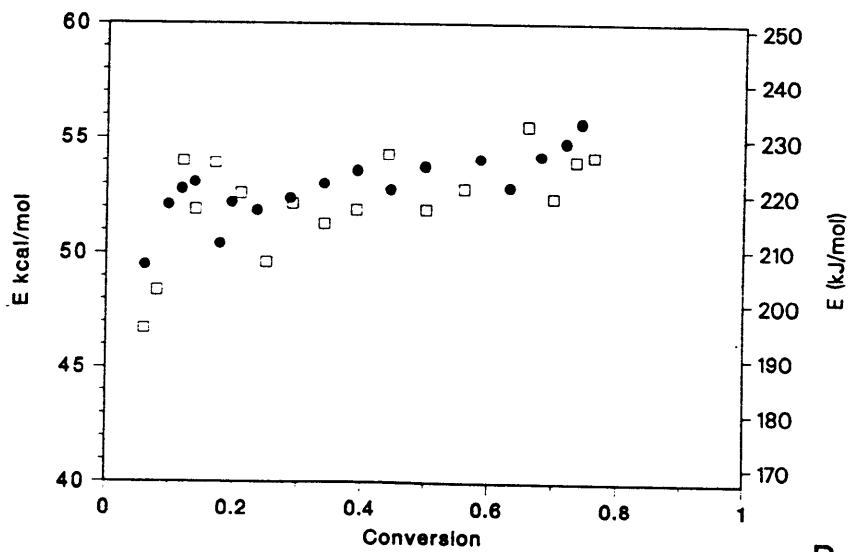
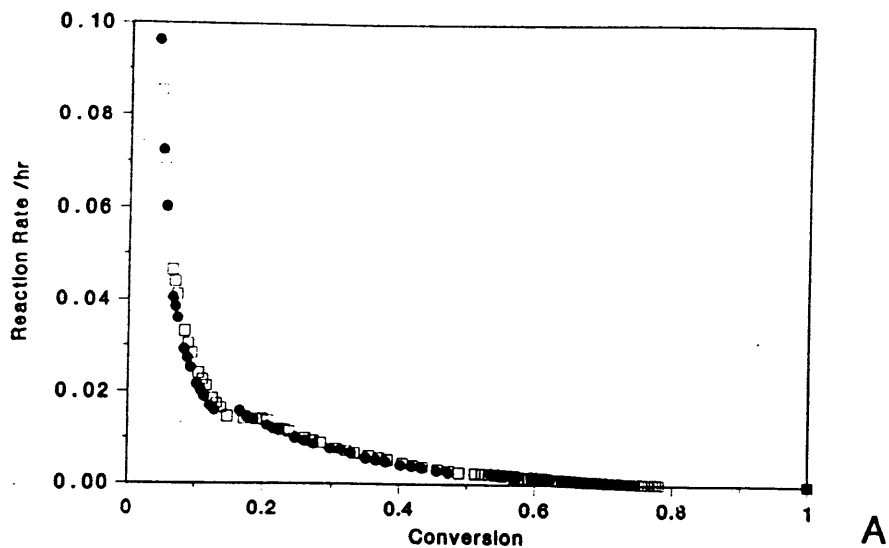
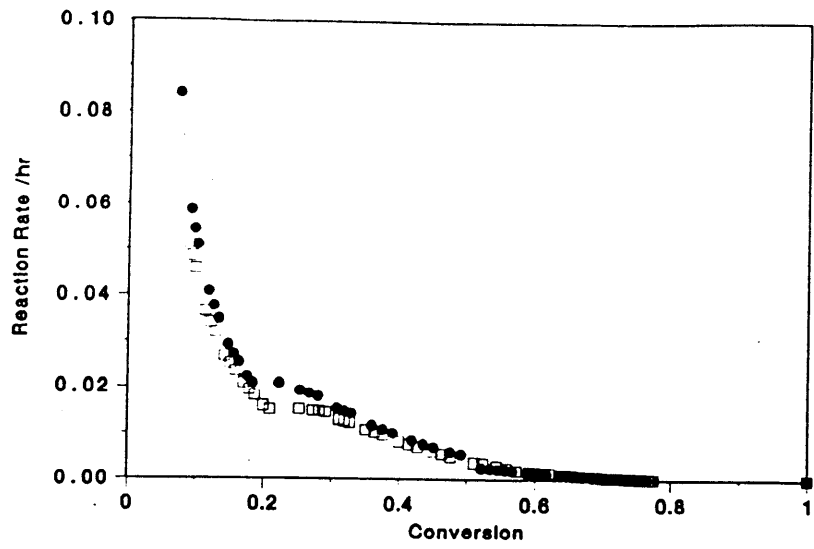
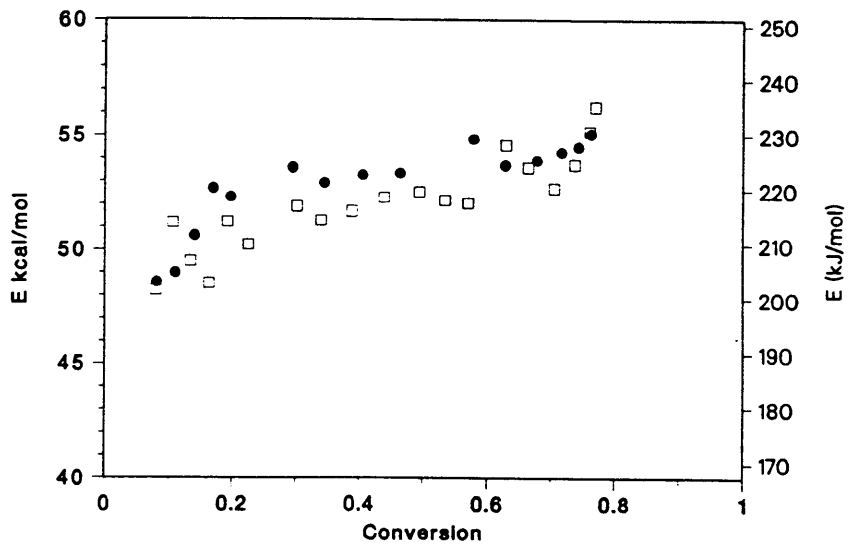


Figure 1

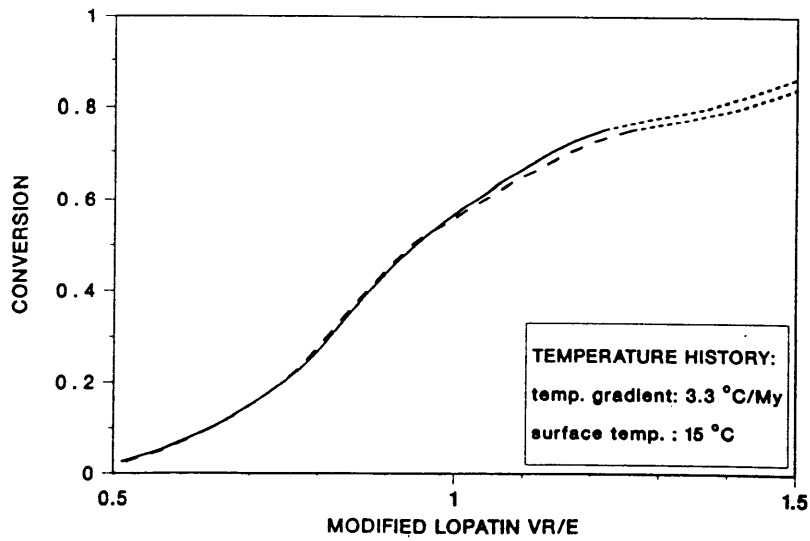
Australia Flounder-1, 8760ft



A



B



C

Figure 2

Australia Morwong-1, 7860ft

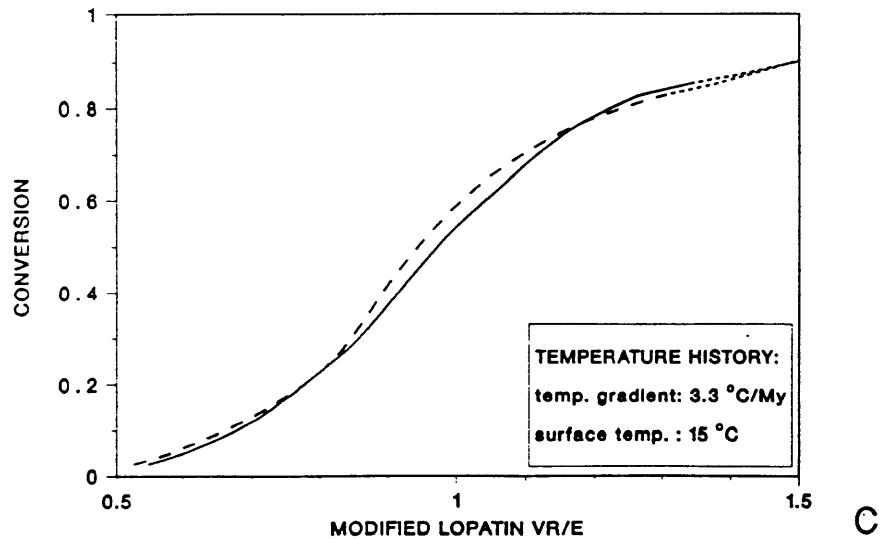
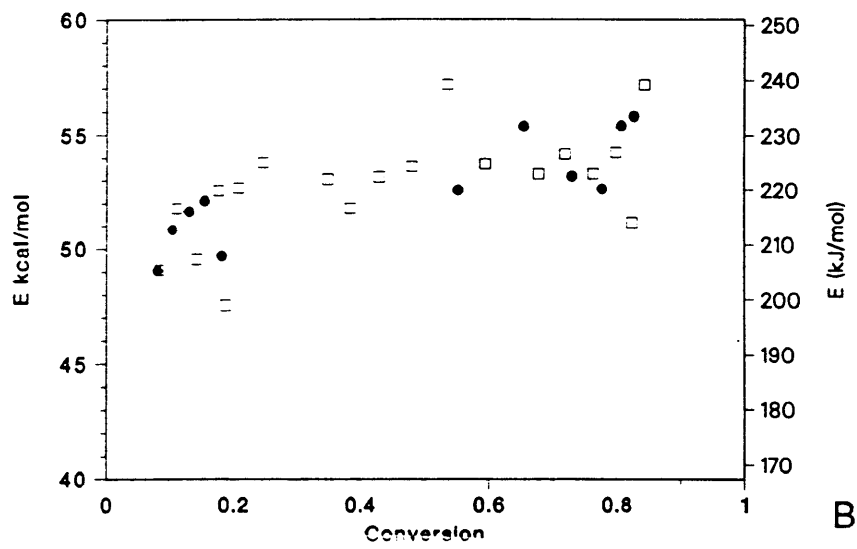
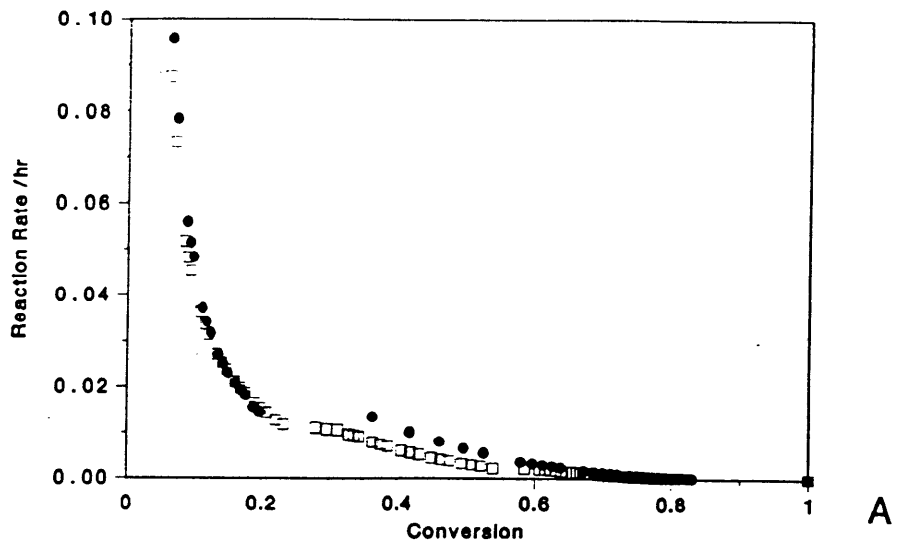


Figure 3

Australia Pilotfish-1, 3040m

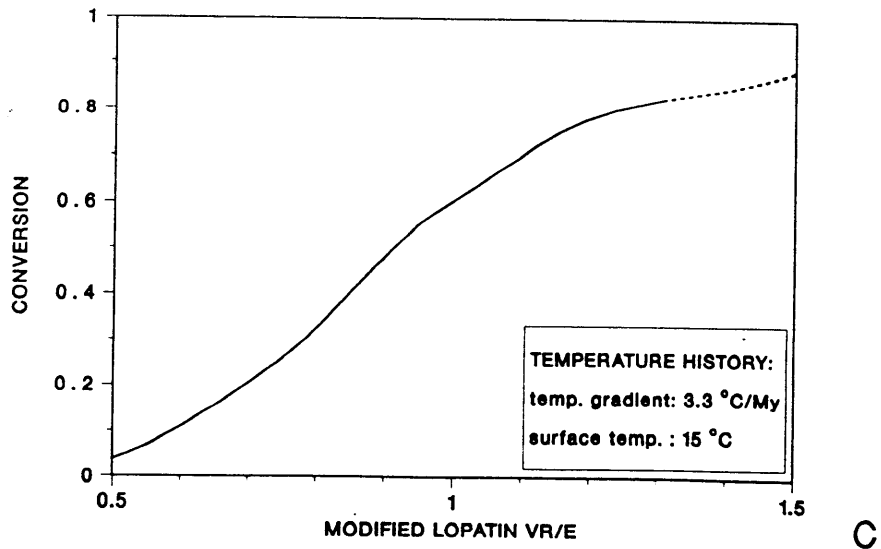
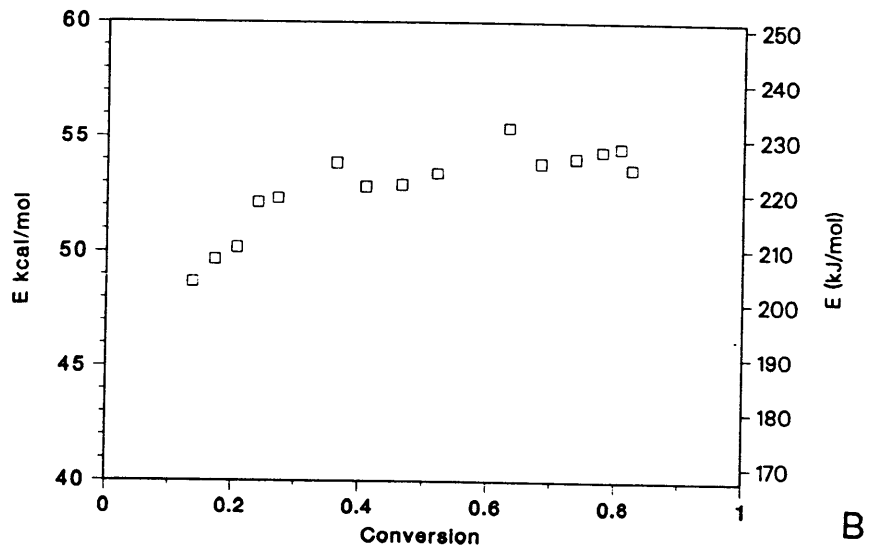
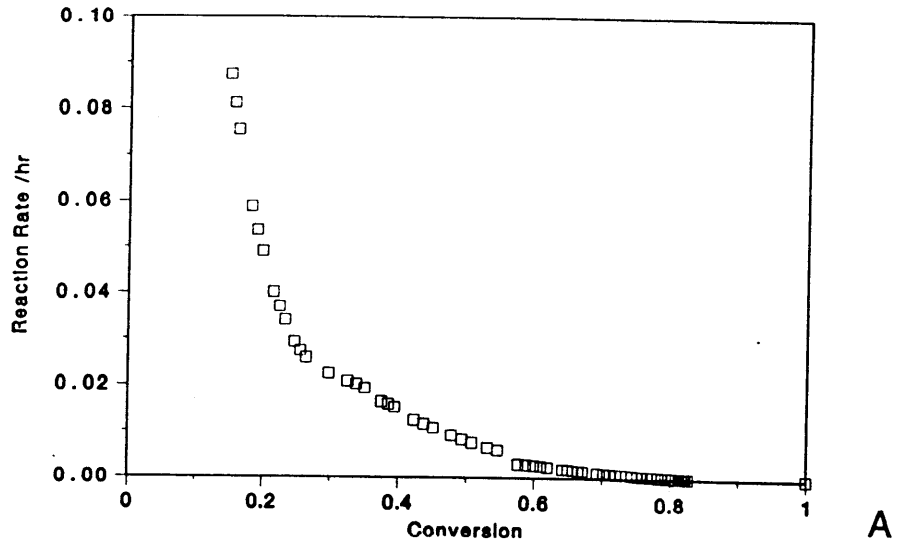


Figure 4

Australia Pilotfish-1, 3050m

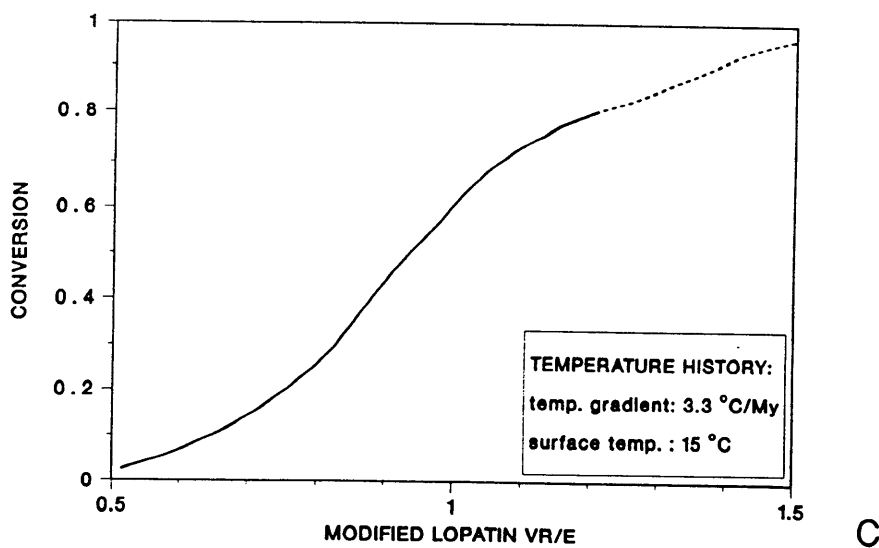
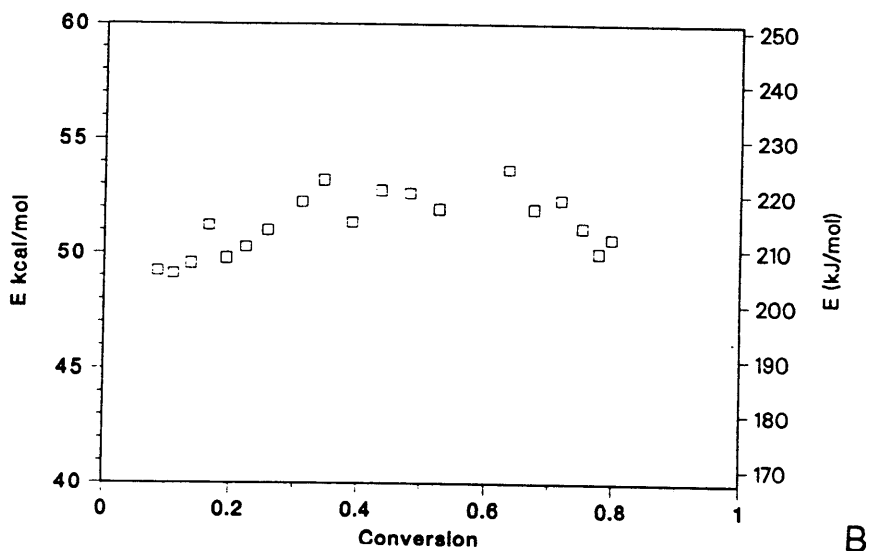
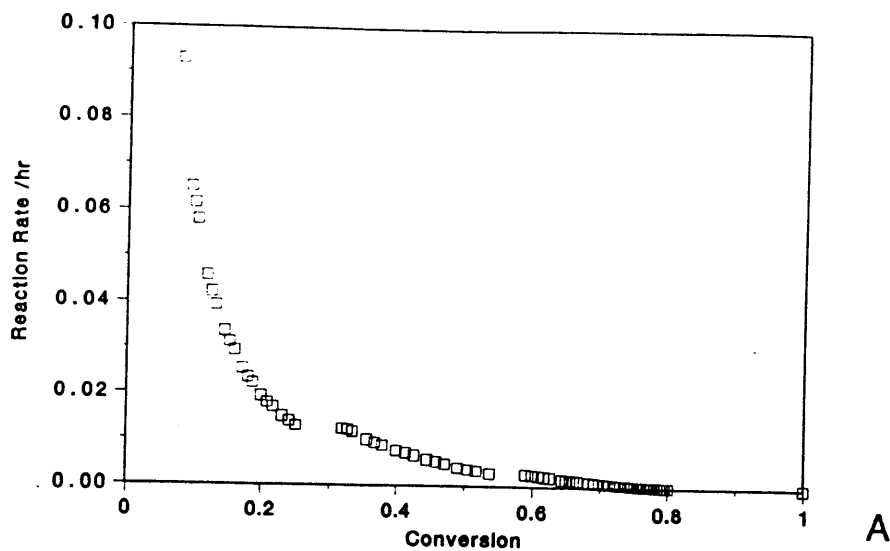


Figure 5

Australia Volador-1, 3573m

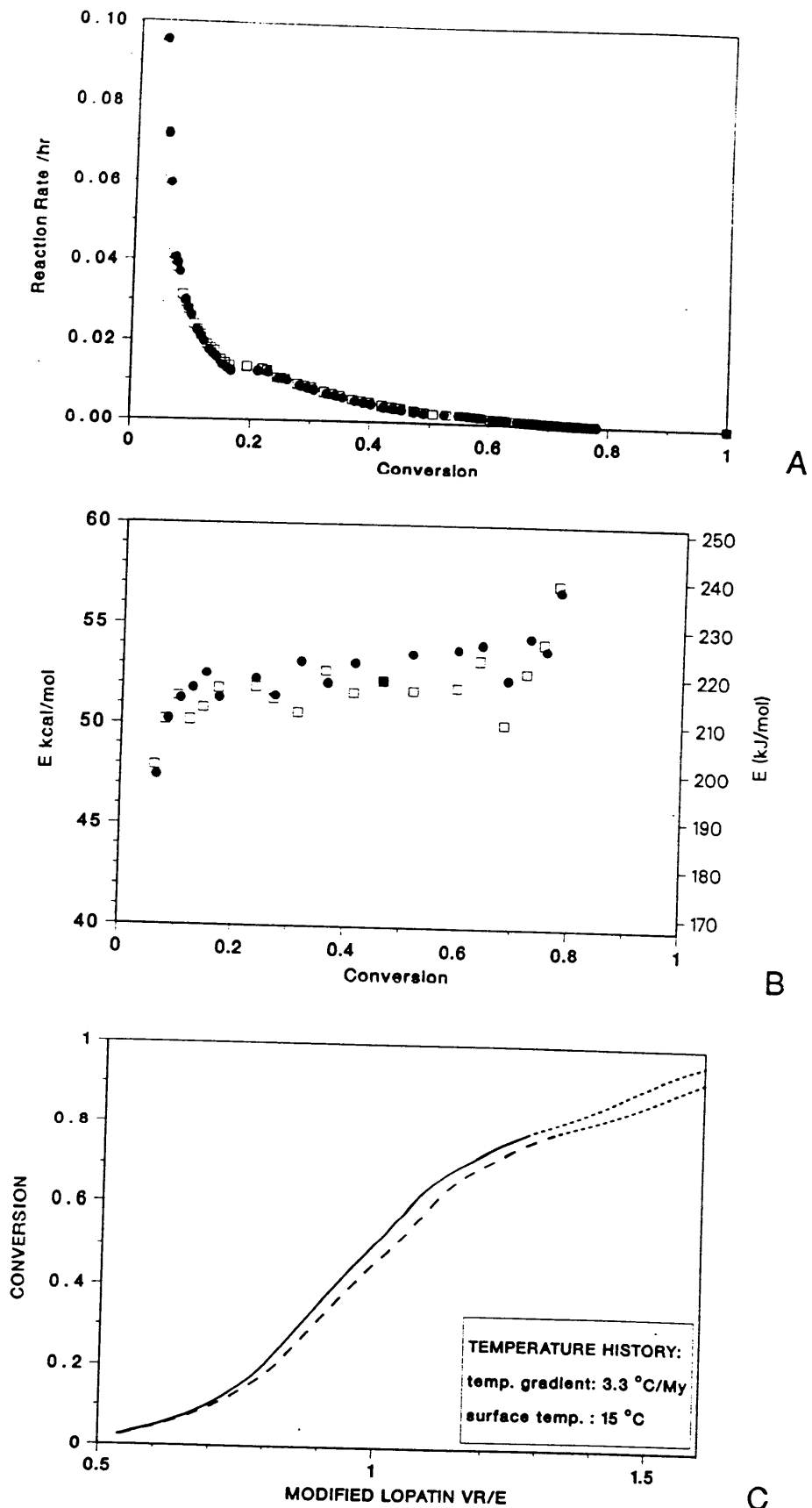
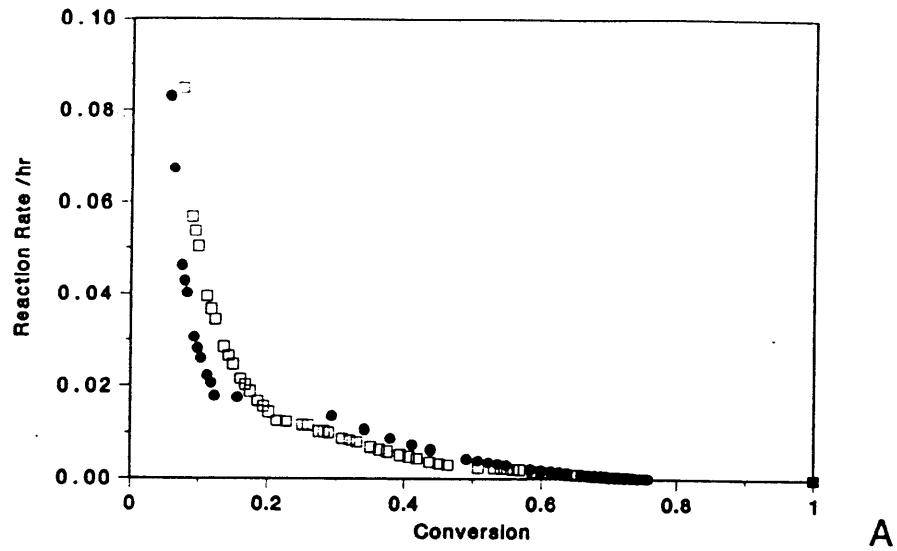


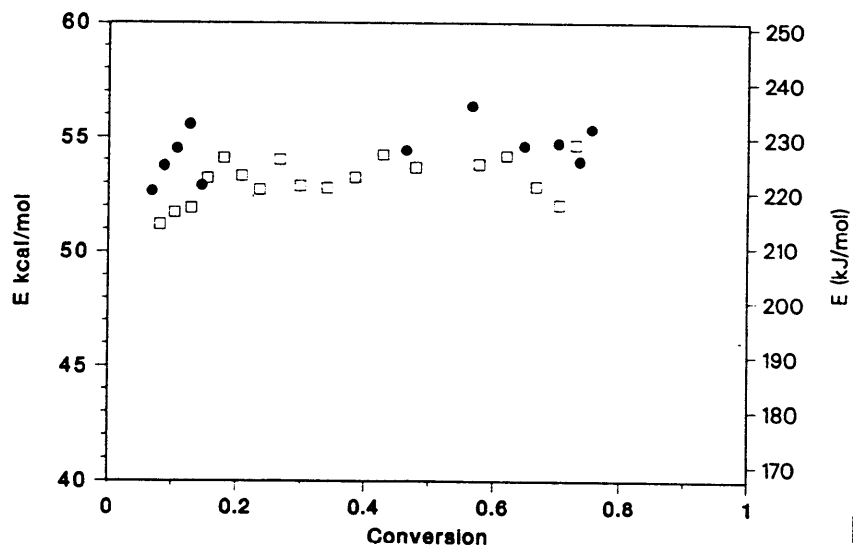
Figure 6



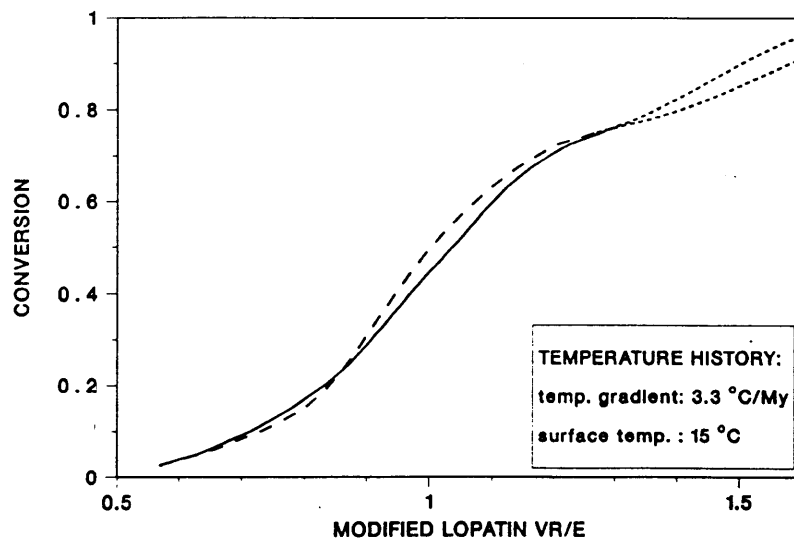
Australia Volador-1, 3552m



A



B



C

Figure 7