# Alpha Spectrometer / Samples (Volume 1)

308 --- Q200405270009

Technical Activity Supporting Documentation:
Experimental Data for Alpha Spectrometer /
Samples (02/02/1993 through 03/03/1993)

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**
**AND CALCULATION OF AGE OF THE SAMPLE Via Isochron**

| | | | |
|---|---|---|---|
| U-234/U-238)a = | **1.2745** | ± | **0.0167** |
| Th-230/U-234)a = | **0.3957** | ± | **0.0456** |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| Age of the sample( yrs ) = | 53572 | ± | 7969 |

Appendix:

| Decay | Th0/(Th0-U4) | Th230 | U234 |
|---|---|---|---|
| constant | 1.435e+00 | 9.215e-06 | 2.794e-06 |

| exp(-D0*T) | e((d4-d0)*T) | RTh0-RTh0' | dTh/dT | dTh/dU | dT | T | T+dT | |
|---|---|---|---|---|---|---|---|---|
| 6.104e-01 | 7.089e-01 | 0.000e+00 | 5.820e-06 | 8.423e-01 | 0.000e+00 | 5.357e+04 | 5.357e+04 | |

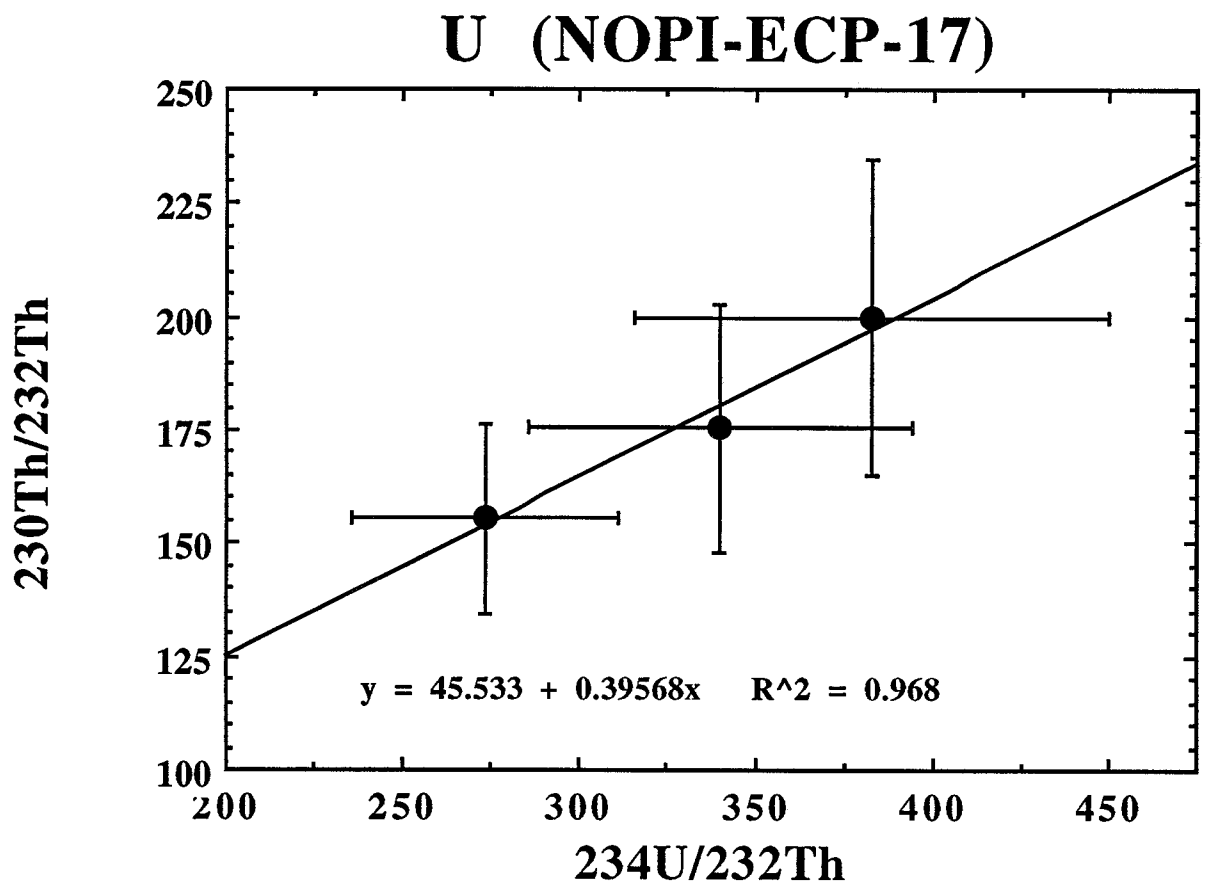
error calculation NOPI-ECP-17

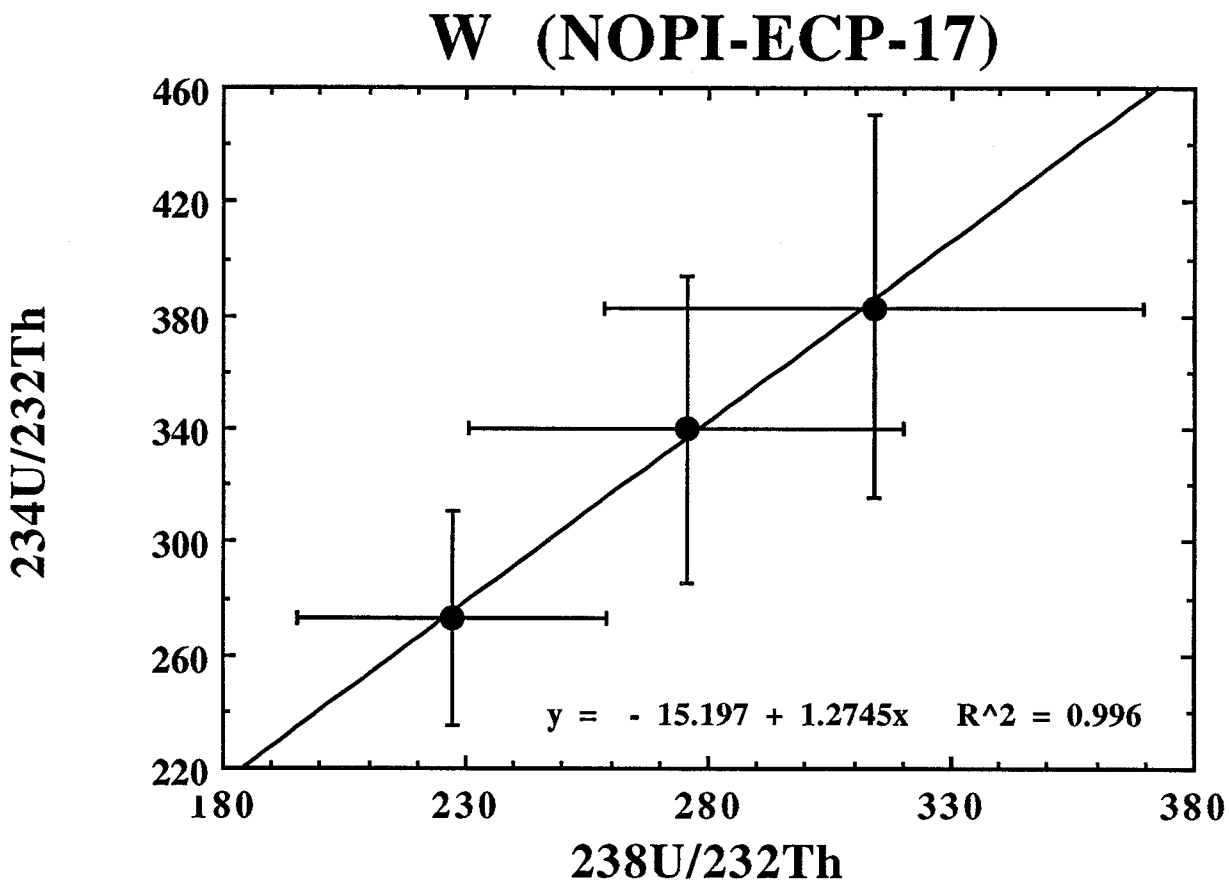
| E234/238 | Sig W | ui | Eui | vi | Errvi | 234/232 | E234/232 |
|---|---|---|---|---|---|---|---|
| 0.0139 | 0.01668672 | 0.5218 | 0.0076 | 0.002612 | 0.0004585 | 382.9107 | 67.2314 |
| 0.0391 | | 0.5163 | 0.0125 | 0.0029443 | 0.0004719 | 339.6366 | 54.4295 |
| 0.028 | | 0.5691 | 0.0109 | 0.0036984 | 0.0005065 | 272.962 | 37.7374 |
| RSquared = | 0.968 | U = | 0.39568 | E = | 45.533 | | |
| sig E ^2 = | 580.501362 | | | | | | |
| Sig U= | 0.04557684 | | | | | | |

Bret Leslie 3/11/93

isochron data NOPI-ECP-17 Thu, Mar 11, 1993 3:28 PM

| | 230/232 (y) | 234/232 (x) | 234/232(y) | 238/232(x) | 230/232 err | 234/232 err | 238/232 err |
|---|---|---|---|---|---|---|---|
| 1 | 199.812 | 382.911 | 382.911 | 314.040 | 34.870 | 67.231 | 55.255 |
| 2 | 175.357 | 339.637 | 339.637 | 275.366 | 27.465 | 54.430 | 44.980 |
| 3 | 155.335 | 272.962 | 272.962 | 227.449 | 21.013 | 37.737 | 31.890 |


U (NOPI-ECP-17)
230Th/232Th
234U/232Th
250
225
200
175
150
125
100
200
250
300
350
400
450
y = 45.533 + 0.39568x R^2 = 0.968


W (NOPI-ECP-17)
234U/232Th
238U/232Th
460
420
380
340
300
260
220
180
230
280
330
380
y = - 15.197 + 1.2745x R^2 = 0.996

NOPI-ECP-17-SEP1

BWL
3/11/93

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**

> 1.0 mm

sample # **NOPI-ECP-17-Sep1** Sep. date **3/3/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 0.4211 | 2.7794 | 22.59 | 12/27/92 | 67 | *22.548331* |

Th228/U232 *0.379*

Counting time for Th = 1087.645 (min.)
Days btwn. sep. & count. = 4 (days)
*CF for Th-228* = *.9957*

Counting time for U = 1861.57 (min.)
Days btwn. sep. & count. = 3 (days)
*CF for U-232* = *1.0035*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 33 | 6556 | 2749 | 263 |

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 13965 | 17028 | 9730 |

| bkgd | bkgd | bkgd | bkgd |
|---|---|---|---|
| 0.0001756 | 0.0003512 | 0.00504 | 0.00544 |

| bkgd | bkgd | bkgd |
|---|---|---|
| 0.0007024 | 0.000878 | 0.00474 |

bkgd time 1 (min.)

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *32.80901* | *6555.61802* | *2708.9703* | *257.083* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *13963.692* | *17026.4* | *9687.2* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **2.15E+02** | ± | **2.83E+00** |
| U-234(dpm/g) = | **2.62E+02** | ± | **3.32E+00** |
| Th-232(dpm/g) = | **6.83E-01** | ± | **1.20E-01** |
| Th-230(dpm/g) = | **1.36E+02** | ± | **3.10E+00** |
| U-234/U-238 = | **1.2193** | ± | **0.0139** |
| Th-230/U-234 = | **0.5218** | ± | **0.0076** |
| Th-230/Th-232 = | **199.8115** | ± | **34.8702** |
| U-234/Th-232 = | **382.9107** | ± | **67.2314** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

**U (ppm) =** **287.429**

**Th (ppm) =** **2.795**

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**
**AND CALCULATION OF AGE OF THE SAMPLE Via Isochron**

| | | | |
|---|---|---|---|
| U-234/U-238)a = | **1.2193** | ± | **0.0139** |
| Th-230/U-234)a = | **0.5218** | ± | **0.0076** |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| Age of the sample( yrs ) = | 77924 | ± | 2298 |

Appendix:

| Decay | Th0/(Th0-U4) | Th230 | U234 |
|---|---|---|---|
| constant | 1.435e+00 | 9.215e-06 | 2.794e-06 |

| exp(-D0*T) | e((d4-d0)*T) | RTh0-RTh0' | dTh/dT | dTh/dU | dT | T | T+dT | |
|---|---|---|---|---|---|---|---|---|
| 4.877e-01 | 6.063e-01 | 0.000e+00 | 4.691e-06 | 8.177e-01 | 0.000e+00 | 7.792e+04 | 7.792e+04 | |

BWL 3/11/93

```
K0SMCB # 1        ACQ 03-06-93  AT 09:09:49   RT : 111694.2   LT : 111690.5
                  No detector description was entered
                  NOPI-ECP-SEP1 U Calcihe

ROI #  7-1        RANGE :    17 =     3.83MeV  to    89 =     4.22MeV
                  AREA : Gross = 13965      Net = 13162        +/- 149
                  CENTROID : 80.76    =     4.19MeV
                  SHAPE : Fwhm =    0.04MeV     Fwtm =    0.11MeV

                  ID :  U-238  at      4.20MeV
                  Corrected Rate = 0.118          +/- 0.00

ROI #  7-2        RANGE :    93 =     4.24MeV  to   128 =     4.43MeV
                  AREA : Gross = 543        Net = 448          +/- 30
                  CENTROID : 117.96   =     4.38MeV
                  SHAPE : Fwhm =    0.04MeV     Fwtm =    0.09MeV

                  ID :  U-235  at      4.37MeV
                  Corrected Rate = 0.004          +/- 0.00

ROI #  7-3        RANGE :   131 =     4.45MeV  to   205 =     4.84MeV
                  AREA : Gross = 17028      Net = 16840        +/- 138
                  CENTROID : 188.39   =     4.75MeV
                  SHAPE : Fwhm =    0.04MeV     Fwtm =    0.10MeV

                  ID :  U-234  at      4.78MeV
                  Corrected Rate = 0.151          +/- 0.00

ROI #  7-4        RANGE :   237 =     5.01MeV  to   299 =     5.35MeV
                  AREA : Gross = 9730       Net = 9478         +/- 109
                  CENTROID : 290.08   =     5.30MeV
                  SHAPE : Fwhm =    0.04MeV     Fwtm =    0.12MeV

                  ID :  U-232  at      5.32MeV
                  Corrected Rate = 0.085          +/- 0.00

-120:             0         0         0         0         0         0         0
     0            0         0         0         0         0         0         0
     0
-110:             0         0         0         0         0         0         0
     0            0         0
-100:             0         0         0         0         0         0         0
     0            0         0
 -90:             0         0         0         0         0         0         0
     0            0         0
 -80:             0         0         0         0         0         0         0
     0            0         0
 -70:             0         0         0         0         0         0         0
     0            0         0
 -60:             0         0         0         0         0         0         0
     0            0         0
 -50:             0         0         0         0         0         0         0
     0            0         0
 -40:             0         0         0         0         0         0         0
     0            0         0
 -30:             0         0         0         0         0         0         0
     0            0         0
 -20:             0         0         0         0         0         0         0
     0            0         0
```

weight of sample = 0.4211g

weight of spike 17A-1A = 2.7794g

counting time = 1861.57 minutes

days between separation & count = 3

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | | | | | |
| 10: | 3 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | | | | | |
| 20: | 2 | 4 | 0 | 1 | 1 | 4 | 3 |
| 1 | 4 | 3 | | | | | |
| 30: | 2 | 3 | 1 | 5 | 5 | 1 | 8 |
| 2 | 3 | 6 | | | | | |
| 40: | 4 | 5 | 9 | 1 | 4 | 12 | 12 |
| 7 | 18 | 13 | | | | | |
| 50: | 11 | 14 | 21 | 17 | 25 | 29 | 40 |
| 38 | 50 | 48 | | | | | |
| 60: | 66 | 67 | 81 | 106 | 98 | 114 | 144 |
| 193 | 206 | 257 | | | | | |
| 70: | 305 | 425 | 460 | 520 | 591 | 625 | 575 |
| 644 | 806 | 995 | | | | | |
| 80: | 1140 | 1277 | 1265 | 1126 | 814 | 390 | 172 |
| 55 | 8 | 0 | | | | | |
| 90: | 4 | 2 | 1 | 2 | 2 | 2 | 3 |
| 1 | 2 | 4 | | | | | |
| 100: | 3 | 4 | 5 | 4 | 8 | 9 | 9 |
| 7 | 12 | 12 | | | | | |
| 110: | 14 | 25 | 22 | 25 | 23 | 43 | 39 |
| 35 | 47 | 52 | | | | | |
| 120: | 37 | 31 | 26 | 13 | 10 | 2 | 2 |
| 8 | 0 | 0 | | | | | |
| 130: | 1 | 3 | 7 | 3 | 0 | 7 | 2 |
| 3 | 3 | 4 | | | | | |
| 140: | 4 | 3 | 8 | 4 | 7 | 5 | 8 |
| 10 | 10 | 11 | | | | | |
| 150: | 12 | 15 | 15 | 19 | 12 | 27 | 17 |
| 19 | 27 | 29 | | | | | |
| 160: | 27 | 25 | 23 | 39 | 52 | 45 | 55 |
| 75 | 74 | 85 | | | | | |
| 170: | 120 | 134 | 143 | 185 | 210 | 274 | 327 |
| 410 | 505 | 671 | | | | | |
| 180: | 671 | 672 | 694 | 664 | 714 | 800 | 984 |
| 1237 | 1431 | 1490 | | | | | |
| 190: | 1427 | 1146 | 713 | 326 | 113 | 37 | 27 |
| 21 | 23 | 21 | | | | | |
| 200: | 25 | 13 | 4 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 210: | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 2 | | | | | |
| 220: | 0 | 3 | 2 | 0 | 1 | 1 | 2 |
| 2 | 0 | 0 | | | | | |
| 230: | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 3 | 2 | | | | | |
| 240: | 1 | 2 | 2 | 1 | 2 | 2 | 0 |
| 1 | 1 | 5 | | | | | |
| 250: | 3 | 9 | 7 | 6 | 10 | 10 | 7 |
| 13 | 13 | 4 | | | | | |
| 260: | 10 | 13 | 8 | 12 | 18 | 19 | 21 |
| 33 | 42 | 37 | | | | | |
| 270: | 45 | 49 | 77 | 89 | 87 | 135 | 154 |
| 180 | 229 | 304 | | | | | |
| 280: | 367 | 404 | 403 | 384 | 316 | 337 | 418 |
| 497 | 623 | 692 | | | | | |
| 290: | 795 | 885 | 801 | 580 | 347 | 148 | 48 |
| 17 | 1 | 0 | | | | | |
| 300: | 2 | 0 | 2 | 1 | 0 | 1 | 1 |
| 4 | 2 | 5 | | | | | |
| 310: | 4 | 3 | 3 | 2 | 2 | 1 | 0 |
| 1 | 0 | 0 | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 320: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 330: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 340: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 350: | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 2 | | | | | |
| 360: | 2 | 2 | 1 | 2 | 0 | 0 | 2 |
| 0 | 0 | 0 | | | | | |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | |

k0G

BWL 3/11/93

```
k0GMCB # 1      ACQ 03-07-93  AT 16:18:02   RT : 65258.7    LT : 65258.0
                No detector description was entered
                NOPI-ECP-SEP1 Thorium Caliche

ROI #  7-1      RANGE :   34 =    3.92MeV  to   51 =    4.02MeV
                AREA : Gross = 33        Net = 14        +/- 7
                Could not properly fit the peak.
```

$^{232}$Th

weight of sample = 0.4211

weight of spike 17A-1A = 2.7794g

counting time = 1087.645

days between separation & count = 4

```
ROI #  7-2      RANGE :  142 =    4.50MeV  to  180 =    4.71MeV
                AREA : Gross = 6556      Net = 6412      +/- 85
                CENTROID : 172.27  =    4.67MeV
                SHAPE : Fwhm =   0.03MeV    Fwtm =   0.06MeV

                ID : Th-230  at     4.69MeV
                Corrected Rate = 0.098        +/- 0.00

ROI #  7-3      RANGE :  282 =    5.25MeV  to  318 =    5.45MeV
                AREA : Gross = 2749      Net = 2674      +/- 55
                CENTROID : 310.56  =    5.41MeV
                SHAPE : Fwhm =   0.03MeV    Fwtm =   0.06MeV

                ID : Th-228  at     5.42MeV
                Corrected Rate = 0.041        +/- 0.00
```

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | | | | | | |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | | | | | | |
| 30: | 1 | 0 | 0 | 0 | 0 | [2 | 1 | |
| 1 | 1 | 0 | | | | | | |
| 40: | 2 | 2 | 1 | 0 | 1 | 1 | 4 | |
| 6 | 7 | 1 | | | | | | |
| 50: | 3] | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 60: | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| 0 | 0 | 2 | | | | | | |
| 70: | 0 | 0 | 3 | 3 | 1 | 3 | 2 | |
| 3 | 4 | 2 | | | | | | |
| 80: | 3 | 4 | 6 | 8 | 6 | 3 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 0 | 0 | 0 | | | | | | |
| 100: | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| 0 | 0 | 2 | | | | | | |
| 110: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | |
| 1 | 0 | 0 | | | | | | |
| 120: | 1 | 1 | 0 | 0 | 2 | 1 | 1 | |
| 1 | 1 | 2 | | | | | | |
| 130: | 1 | 1 | 1 | 3 | 1 | 3 | 1 | |
| 3 | 3 | 4 | | | | | | |
| 140: | 0 | 0 | 0 | [3 | 1 | 3 | 4 | |
| 4 | 7 | 7 | | | | | | |
| 150: | 10 | 13 | 8 | 11 | 19 | 38 | 58 | |
| 91 | 141 | 197 | | | | | | |
| 160: | 234 | 221 | 192 | 128 | 91 | 85 | 109 | |
| 146 | 204 | 327 | | | | | | |
| 170: | 484 | 715 | 874 | 791 | 709 | 396 | 171 | |

$^{232}$Th

230 = 6556

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 180: | 0 | 2 | 2 | 1 | 0 | 1 | 4 | |
| 1 | 5 | 8 | | | | | | |
| 190: | 8 | 4 | 1 | 1 | 1 | 0 | 1 | |
| 1 | 0 | 1 | | | | | | |
| 200: | 1 | 1 | 1 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 220: | 0 | 0 | 2 | 1 | 0 | 1 | 0 | |
| 0 | 0 | 1 | | | | | | |
| 230: | 0 | 2 | 2 | 1 | 0 | 0 | 2 | |
| 0 | 0 | 0 | | | | | | |
| 240: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 1 | 0 | 0 | | | | | | |
| 250: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 1 | 0 | 0 | | | | | | |
| 260: | 0 | 1 | 0 | 0 | 0 | 1 | 1 | |
| 2 | 1 | 3 | | | | | | |
| 270: | 1 | 3 | 3 | 0 | 1 | 1 | 1 | |
| 0 | 3 | 0 | | | | | | |
| 280: | 2 | 2 | [0 | 3 | 3 | 4 | 3 | 228Th |
| 3 | 4 | 13 | | | | | | |
| 290: | 14 | 19 | 35 | 63 | 87 | 91 | 96 | |
| 86 | 42 | 36 | | | | | | |
| 300: | 25 | 22 | 21 | 33 | 31 | 58 | 71 | |
| 121 | 171 | 276 | | | | | | |
| 310: | 344 | 348 | 321 | 177 | 87 | 34 | 5 | |
| 2 | 0] | 1 | | | | | | |
| 320: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 330: | 1 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 0 | 0 | 0 | | | | | | |
| 340: | 0 | 2 | 1 | 0 | 1 | 0 | 2 | |
| 4 | 3 | 1 | | | | | | |
| 350: | 3 | 0 | [4 | 4 | 8 | 7 | 19 | 224Ra = 263 cts |
| 16 | 31 | 32 | | | | | | |
| 360: | 25 | 37 | 21 | 19 | 14 | 10 | 10 | |
| 4 | 2] | 4 | | | | | | |
| 370: | 5 | 10 | 7 | 11 | 9 | 12 | 6 | 5.25 keV / Ch |
| 0 | 3 | 4 | | | | | | |
| 380: | 0 | 2 | 0 | 1 | 1 | 1 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 390: | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 50 ch between 228 & peaks |
| 1 | 0 | 1 | | | | | | |
| 400: | 0 | 0 | 0 | 1 | 1 | 2 | 2 | |
| 0 | 3 | 2 | | | | | | |
| 410: | 1 | 4 | 5 | 10 | 17 | 5 | 8 | |
| 14 | 13 | 7 | | | | | | |
| 420: | 13 | 10 | 3 | 5 | 17 | 11 | 15 | |
| 18 | 6 | 6 | | | | | | |
| 430: | 1 | 4 | 0 | 0 | 1 | 2 | 3 | |
| 0 | 0 | 1 | | | | | | |
| 440: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 450: | 0 | 0 | 0 | 1 | 1 | 0 | 0 | |
| 1 | 1 | 1 | | | | | | |
| 460: | 1 | 0 | 1 | 2 | 3 | 0 | 1 | |
| 3 | 7 | 11 | | | | | | |
| 470: | 19 | 20 | 24 | 28 | 26 | 19 | 14 | |
| 6 | 4 | 4 | | | | | | |
| 480: | 2 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 490: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | | | | | | |
| 500: | 22 | 35 | 21 | 14 | 20 | 37 | 29 | |
| [illegible] | [illegible] | [illegible] | | | | | | |

NOPI-ECP-17-SEP2 BWL 3/11/93

~~Assume f~~

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**

250μ < x < 1mm

sample # **NOPI-ECP-17-Sep2** Sep. date **3/3/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 0.2228 | 1.8883 | 22.59 | 12/27/92 | 67 | *22.548331* |

Th228/U232 *0.379*

Counting time for Th = 2862.69 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for Th-228* = *.9941*

Counting time for U = 1037.14 (min.)
Days btwn. sep. & count. = 4 (days)
*CF for U-232* = *1.0042*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 41 | 7103 | 3997 | 1064 |

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 1794 | 2225 | 1687 |

| bkgd | bkgd | bkgd | bkgd |
|---|---|---|---|
| 0.0001756 | 0.0005268 | 0.01317 | 0.006322 |

| bkgd | bkgd | bkgd |
|---|---|---|
| 0.004748 | 0.017753 | 0.03365 |

bkgd time 1 (min.)

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *40.49731* | *7101.49193* | *3886.6608* | *1045.9* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *1789.0757* | *2206.59* | *1645.2* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **2.08E+02** | ± | **7.05E+00** |
| U-234(dpm/g) = | **2.56E+02** | ± | **8.27E+00** |
| Th-232(dpm/g) = | **7.55E-01** | ± | **1.18E-01** |
| Th-230(dpm/g) = | **1.32E+02** | ± | **2.62E+00** |
| U-234/U-238 = | **1.2334** | ± | **0.0391** |
| Th-230/U-234 = | **0.5163** | ± | **0.0125** |
| Th-230/Th-232 = | **175.3571** | ± | **27.4651** |
| U-234/Th-232 = | **339.6366** | ± | **54.4295** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

**U (ppm) =** **278.437**

**Th (ppm) =** **3.087**

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**
**AND CALCULATION OF AGE OF THE SAMPLE Via Isochron**

| | | | |
|---|---|---|---|
| U-234/U-238)a = | **1.2334** | ± | **0.0391** |
| Th-230/U-234)a = | **0.5163** | ± | **0.0125** |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| Age of the sample( yrs ) = | 76656 | ± | 5152 |

Appendix:

| Decay | Th0/(Th0-U4) | Th230 | U234 |
|---|---|---|---|
| constant | 1.435e+00 | 9.215e-06 | 2.794e-06 |

| exp(-D0*T) | e((d4-d0)*T) | RTh0-RTh0' | dTh/dT | dTh/dU | dT | T | T+dT | |
|---|---|---|---|---|---|---|---|---|
| 4.934e-01 | 6.113e-01 | -1.110e-16 | 4.753e-06 | 8.191e-01 | -2.336e-11 | 7.666e+04 | 7.666e+04 | |
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BWL
3/11/93

```
k0GMCB # 1        ACQ 03-07-93  AT 17:01:58    RT : 62228.4     LT : 62227.7
                No detector description was entered
                NOPI-ECP-17-SEP2 Uranium Caliche

ROI #  1-1      RANGE :     8 =     3.89MeV  to    73 =     4.21MeV
                AREA : Gross = 1794        Net = 1646        +/- 56
                CENTROID : 63.19    =     4.16MeV
                SHAPE : Fwhm =    0.04MeV     Fwtm =    0.12MeV

                ID :  U-238  at      4.15MeV
                Corrected Rate = 0.026          +/- 0.00

ROI #  1-2      RANGE :    85 =     4.27MeV  to   106 =     4.37MeV
                AREA : Gross = 57          Net = 27          +/- 10
                Could not properly fit the peak.

ROI #  1-3      RANGE :   125 =     4.47MeV  to   185 =     4.76MeV
                AREA : Gross = 2230        Net = 1986        +/- 45
                CENTROID : 176.11   =     4.72MeV
                SHAPE : Fwhm =    0.08MeV     Fwtm =    0.12MeV

                ID :  U-234  at      4.72MeV
                Corrected Rate = 0.032          +/- 0.00

ROI #  1-4      RANGE :   243 =     5.05MeV  to   294 =     5.30MeV
                AREA : Gross = 1687        Net = 1596        +/- 40
                CENTROID : 284.90   =     5.26MeV
                SHAPE : Fwhm =    0.04MeV     Fwtm =    0.13MeV

                ID :  U-232  at      5.26MeV
                Corrected Rate = 0.026          +/- 0.00

  -16:          0          0          0          0          0          0          0
    0           0          0          0          0          0          0          0 09
253829
    0:          0          0          0          0          0          0          0
    0           0          0
   10:          6          1          3          1          0          3          2
    1           2          1
   20:          2          2          2          1          4          1          3
    2           5          5
   30:          4         10          4          8          6          5          6
    7          10         11
   40:         14         10         14         15         14         23         21
   23          32         46
   50:         34         41         60         59         70         53         65
   55          66         56
   60:         83         99        120        115        127        128        100
   71          84         17
   70:          3          4          2          0          2          0          0
    0           3          1
   80:          1          1          2          1          3          0          0
    2           1          2
   90:          3          2          4          4          4          3          0
    5           1          5
  100:          3          1          6          5          2          3          1
    0           1          1
  110:          3          3          1          2          0          2          0
```

238U
=
1794

weight of sample = .2228 g

weight of spike 17A-1A = 1.8883 g

counting time = 1037.14 min

days between separation & count = 4

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 120: | 0 | 0 | 1 | 2 | 2 | 0 | 257 ∪ | [3 |
| 3 | 1 | 3 | | | | | 11 | |
| 130: | 2 | 2 | 1 | 2 | 6 | 4 | | 4 |
| 2 | 4 | 4 | | | | | 2225 | |
| 140: | 8 | 3 | 5 | 6 | 3 | 8 | | 4 |
| 8 | 7 | 11 | | | | | | |
| 150: | 8 | 8 | 10 | 5 | 14 | 13 | | 25 |
| 17 | 23 | 22 | | | | | | |
| 160: | 38 | 40 | 51 | 54 | 78 | 83 | | 87 |
| 89 | 87 | 77 | | | | | | |
| 170: | 81 | 77 | 84 | 88 | 107 | 147 | | 134 |
| 146 | 162 | 115 | | | | | | |
| 180: | 77 | 38 | 16 | 10 | 3] | 5 | | 1 |
| 4 | 3 | 6 | | | | | | |
| 190: | 3 | 1 | 2 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 1 | | | | | | |
| 200: | 1 | 0 | 0 | 2 | 1 | 0 | | 0 |
| 1 | 1 | 0 | | | | | | |
| 210: | 0 | 0 | 0 | 0 | 0 | 2 | | 1 |
| 0 | 0 | 0 | | | | | | |
| 220: | 0 | 1 | 0 | 1 | 0 | 0 | | 0 |
| 1 | 0 | 3 | | | | | | |
| 230: | 1 | 0 | 1 | 0 | 1 | 1 | | 0 |
| 0 | 2 | 1 | | | | | | |
| 240: | 2 | 1 | 0 | 0 | 232 ∪ [3 | 3 | | 5 |
| 2 | 3 | 5 | | | | | | |
| 250: | 2 | 2 | 7 | 3 | 11 3 | 9 | | 6 |
| 11 | 6 | 6 | | | | | | |
| 260: | 14 | 15 | 17 | 14 | 1687 11 | 13 | | 27 |
| 20 | 26 | 33 | | | | | | |
| 270: | 47 | 37 | 50 | 48 | 66 | 75 | | 51 |
| 64 | 58 | 65 | | | | | | |
| 280: | 62 | 56 | 68 | 84 | 106 | 114 | | 116 |
| 107 | 72 | 39 | | | | | | |
| 290: | 20 | 12 | 1 | 2] | 1 | 0 | | 2 |
| 2 | 2 | 1 | | | | | | |
| 300: | 0 | 1 | 2 | 3 | 3 | 1 | | 2 |
| 5 | 3 | 1 | | | | | | |
| 310: | 1 | 2 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 320: | 0 | 1 | 1 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 330: | 0 | 0 | 0 | 1 | 0 | 0 | | 0 |
| 0 | 1 | 1 | | | | | | |
| 340: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 1 | 2 | 1 | | | | | | |
| 350: | 3 | 2 | 4 | 1 | 0 | 3 | | 6 |
| 4 | 1 | 7 | | | | | | |
| 360: | 3 | 2 | 3 | 4 | 0 | 1 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 380: | 0 | 0 | 1 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 410: | 0 | 0 | 1 | 0 | 0 | 0 | | 0 |
| 0 | 1 | 0 | | | | | | |
| 420: | 0 | 0 | 0 | 1 | 0 | 1 | | 1 |
| 0 | 0 | 0 | | | | | | |
| 430: | 0 | 0 | 0 | 1 | 0 | 0 | | 0 |
| 1 | 1 | 0 | | | | | | |
| 440: | 0 | 3 | 0 | 0 | 1 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |

```
450:    0    0    0    0    0    1    0
     0    0    0
460:    0    1    0    0    0    0    0
     0    0    1
470:    0    1    1    0    1    0    1
     1    5    2
480:    2    2    4    6    3    1    0
     0    0    0
490:    0    0    0    0    0    0
K0G
```

BWL
3/11/93

k0GMCB # 1 ACQ 03-08-93 AT 10:35:26 RT : 171761.1 LT : 171742.4
No detector description was entered
NOPI-ECP-17-sep2 Thorium caliche

Counting time = 2862.69 min

ROI # 7-1 RANGE : 31 = 3.91MeV to 51 = 4.02MeV
AREA : Gross = 41 Net = -1 +/- 10
Could not properly fit the peak.

ROI # 7-2 RANGE : 94 = 4.25MeV to 181 = 4.71MeV
AREA : Gross = 7103 Net = 6825 +/- 103
CENTROID : 172.14 = 4.67MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.12MeV

ID : Th-230 at 4.69MeV
Corrected Rate = 0.040 +/- 0.00

days between separation & count = 5

ROI # 7-3 RANGE : 245 = 5.06MeV to 320 = 5.46MeV
AREA : Gross = 3997 Net = 3731 +/- 83
CENTROID : 310.11 = 5.41MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.13MeV

ID : Th-228 at 5.42MeV
Corrected Rate = 0.022 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -14: | 8 | 5 | 64 | 75 | 89 | 86 | 74 |
| 78 | 72 | 85 | 64 | 60 | 60 | 13 | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | | | | | |
| 10: | 0 | 0 | 1 | 0 | 2 | 3 | 0 |
| 0 | 2 | 1 | | | | | |
| 20: | 0 | 1 | 1 | 1 | 4 | 0 | 1 |
| 1 | 0 | 1 | | | | | |
| 30: | 0 | 0 | 2 | 2 | 1 | 0 | 1 |
| 1 | 0 | 2 | | | | | |
| 40: | 2 | 1 | 1 | 2 | 5 | 1 | 3 |
| 5 | 4 | 6 | | | | | |
| 50: | 2 | 0 | 1 | 1 | 0 | 1 | 0 |
| 8 | 0 | 1 | | | | | |
| 60: | 0 | 0 | 0 | 2 | 1 | 3 | 0 |
| 0 | 2 | 3 | | | | | |
| 70: | 2 | 1 | 8 | 1 | 4 | 2 | 4 |
| 0 | 6 | 3 | | | | | |
| 80: | 9 | 0 | 8 | 9 | 2 | 7 | 1 |
| 4 | 1 | 2 | | | | | |
| 90: | 3 | 2 | 2 | 2 | 1 | 3 | 7 |
| 1 | 1 | 4 | | | | | |
| 100: | 5 | 4 | 1 | 3 | 3 | 1 | 4 |
| 7 | 12 | 6 | | | | | |
| 110: | 5 | 6 | 7 | 7 | 7 | 5 | 10 |
| 13 | 6 | 9 | | | | | |
| 120: | 10 | 8 | 8 | 14 | 7 | 14 | 10 |
| 9 | 12 | 12 | | | | | |
| 130: | 11 | 6 | 17 | 14 | 16 | 24 | 16 |
| 20 | 30 | 27 | | | | | |
| 140: | 12 | 27 | 21 | 29 | 28 | 31 | 30 |
| 38 | 31 | 36 | | | | | |
| 150: | 59 | 57 | 40 | 52 | 69 | 85 | 97 |
| 138 | 154 | 209 | | | | | |
| 160: | 234 | 226 | 197 | 160 | 137 | 129 | 116 |

232Th = 41

230Th = 7103

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 170: | 430 | 584 | 681 | 677 | 500 | 335 | 157 |
| 41 | 12 | 6 | | | | | |
| 180: | 2] | 0 | 0 | 2 | 3 | 2 | 2 |
| 3 | 2 | 3 | | | | | |
| 190: | 9 | 6 | 1 | 4 | 1 | 1 | 0 |
| 1 | 1 | 3 | | | | | |
| 200: | 0 | 0 | 3 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | | | | | |
| 210: | 1 | 0 | 2 | 2 | 1 | 1 | 1 |
| 0 | 1 | 0 | | | | | |
| 220: | 0 | 1 | 2 | 2 | 2 | 2 | 0 |
| 1 | 0 | 1 | | | | | |
| 230: | 1 | 3 | 3 | 2 | 0 | 0 | 5 |
| 1 | 2 | 0 | | | | | |
| 240: | 2 | 4 | 5 | 2 | 2 | [0 | 7 |
| 2 | 2 | 3 | | | | | |
| 250: | 2 | 2 | 5 | 6 | 5 | 2 | 3 |
| 4 | 2 | 2 | | | | | |
| 260: | 5 | 2 | 6 | 3 | 5 | 10 | 6 |
| 12 | 9 | 11 | | | | | |
| 270: | 10 | 14 | 10 | 11 | 6 | 9 | 17 |
| 12 | 16 | 21 | | | | | |
| 280: | 14 | 15 | 17 | 24 | 24 | 18 | 29 |
| 22 | 34 | 36 | | | | | |
| 290: | 33 | 60 | 75 | 89 | 104 | 95 | 127 |
| 100 | 81 | 66 | | | | | |
| 300: | 52 | 44 | 52 | 73 | 79 | 95 | 129 |
| 176 | 246 | 336 | | | | | |
| 310: | 376 | 383 | 285 | 203 | 93 | 32 | 15 |
| 9 | 7 | 3 | | | | | |
| 320: | 2] | 2 | 2 | 2 | 2 | 2 | 3 |
| 3 | 3 | 4 | | | | | |
| 330: | 0 | [4 | 4 | 4 | 3 | 2 | 4 |
| 3 | 3 | 5 | | | | | |
| 340: | 7 | 5 | 5 | 10 | 9 | 10 | 15 |
| 1 | 18 | 13 | | | | | |
| 350: | 7 | 14 | 18 | 17 | 33 | 31 | 51 |
| 66 | 107 | 108 | | | | | |
| 360: | 118 | 116 | 69 | 74 | 50 | 25 | 15 |
| 11 | 7 | 2] | | | | | |
| 370: | 4 | 9 | 13 | 10 | 9 | 7 | 9 |
| 5 | 2 | 4 | | | | | |
| 380: | 1 | 5 | 1 | 3 | 4 | 4 | 2 |
| 1 | 2 | 4 | | | | | |
| 390: | 4 | 2 | 1 | 5 | 0 | 7 | 0 |
| 4 | 2 | 2 | | | | | |
| 400: | 0 | 2 | 0 | 4 | 0 | 1 | 1 |
| 3 | 5 | 3 | | | | | |
| 410: | 2 | 5 | 7 | 10 | 9 | 9 | 9 |
| 22 | 11 | 8 | | | | | |
| 420: | 3 | 12 | 14 | 11 | 12 | 16 | 22 |
| 23 | 22 | 17 | | | | | |
| 430: | 21 | 12 | 10 | 24 | 18 | 12 | 10 |
| 4 | 8 | 2 | | | | | |
| 440: | 5 | 9 | 5 | 5 | 5 | 3 | 3 |
| 2 | 3 | 4 | | | | | |
| 450: | 7 | 2 | 6 | 5 | 6 | 7 | 7 |
| 5 | 9 | 6 | | | | | |
| 460: | 10 | 9 | 6 | 11 | 15 | 10 | 25 |
| 33 | 39 | 57 | | | | | |
| 470: | 66 | 100 | 91 | 90 | 78 | 77 | 46 |
| 35 | 19 | 10 | | | | | |
| 480: | 6 | 5 | 1 | 1 | 1 | 1 | 0 |
| 0 | 2 | 0 | | | | | |
| 490: | 1 | 1 | 0 | 0 | 0 | 0 | 1 |

228Th
11
3997

224Ra
11
1064

## MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES

125 > X > 63

sample # **NOPI-ECP-17-Sep4** Sep. date **3/3/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 0.2531 | 1.9553 | 22.59 | 12/27/92 | 67 | *22.548331* |

Th228/U232 *0.379*

Counting time for Th = 2867.67 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for Th-228* = *.9941*

Counting time for U = 851.99 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for U-232* = *1.0051*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 55 | 8497 | 3524 | 787 |

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 3364 | 4052 | 2493 |

| bkgd | bkgd | bkgd | bkgd |
|---|---|---|---|
| 0.0001154 | 0.0017316 | 0.0048485 | 0.006349 |

| bkgd | bkgd | bkgd |
|---|---|---|
| 0.004748 | 0.023326 | 0.03674 |

bkgd time 1 (min.)

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *54.66907* | *8492.03434* | *3435.387* | *768.793* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *3359.9548* | *4032.13* | *2449.2* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **2.39E+02** | ± | **6.32E+00** |
| U-234(dpm/g) = | **2.87E+02** | ± | **7.30E+00** |
| Th-232(dpm/g) = | **1.05E+00** | ± | **1.43E-01** |
| Th-230(dpm/g) = | **1.63E+02** | ± | **3.27E+00** |
| U-234/U-238 = | **1.2001** | ± | **0.0280** |
| Th-230/U-234 = | **0.5691** | ± | **0.0109** |
| Th-230/Th-232 = | **155.3353** | ± | **21.0131** |
| U-234/Th-232 = | **272.9620** | ± | **37.7374** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

**U (ppm) =** **320.176**

**Th (ppm) =** **4.298**

**MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES**
**AND CALCULATION OF AGE OF THE SAMPLE Via Isochron**

| | | | |
|---|---|---|---|
| U-234/U-238)a = | **1.2001** | ± | **0.0280** |
| Th-230/U-234)a = | **0.5691** | ± | **0.0109** |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| Age of the sample( yrs ) = | 88671 | ± | 4478 |

Appendix:

| Decay | Th0/(Th0-U4) | Th230 | U234 |
|---|---|---|---|
| constant | 1.435e+00 | 9.215e-06 | 2.794e-06 |

| exp(-D0*T) | e((d4-d0)*T) | RTh0-RTh0' | dTh/dT | dTh/dU | dT | T | T+dT | |
|---|---|---|---|---|---|---|---|---|
| 4.417e-01 | 5.659e-01 | 0.000e+00 | 4.261e-06 | 8.056e-01 | 0.000e+00 | 8.867e+04 | 8.867e+04 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

BWL
3/11/93

```
k0SMCB # 1      ACQ 03-08-93  AT 10:35:41   RT : 51119.6    LT : 51117.4
                No detector description was entered
                NOPI-ECP-17-SEP4 Uranium

ROI #  1-1      RANGE :    7 =    3.88MeV  to   71 =    4.20MeV
                AREA : Gross = 3364       Net = 3050       +/- 78
                CENTROID : 62.11   =    4.16MeV
                SHAPE : Fwhm =   0.07MeV    Fwtm =   0.13MeV

                ID :  U-238  at     4.15MeV
                Corrected Rate = 0.060        +/- 0.00

ROI #  1-2      RANGE :   80 =    4.25MeV  to  109 =    4.39MeV
                AREA : Gross = 137        Net = 77         +/- 18
                CENTROID : 99.86   =    4.34MeV
                SHAPE : Fwhm =   0.02MeV    Fwtm =   0.07MeV

                ID :  U-235  at     4.34MeV
                Corrected Rate = 0.002        +/- 0.00

ROI #  1-3      RANGE :  119 =    4.44MeV  to  191 =    4.79MeV
                AREA : Gross = 4052       Net = 3978       +/- 69
                CENTROID : 173.23  =    4.71MeV
                SHAPE : Fwhm =   0.08MeV    Fwtm =   0.15MeV

                ID :  U-234  at     4.72MeV
                Corrected Rate = 0.078        +/- 0.00

ROI #  1-4      RANGE :  243 =    5.05MeV  to  296 =    5.31MeV
                AREA : Gross = 2493       Net = 2384       +/- 57
                CENTROID : 283.52  =    5.25MeV
                SHAPE : Fwhm =   0.10MeV    Fwtm =   0.14MeV

                ID :  U-232  at     5.26MeV
                Corrected Rate = 0.047        +/- 0.00
```

weight of sample = 0.2531 g

weight of spike #17A-1A = 1.9553 g

counting time = 851.99 min

days between separation & counting = 5

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -16: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 82 |
| 253829 | | | | | | | | |
| 0: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 0 | 1 | 1 | | | | | | |
| 10: | 1 | 2 | 3 | 2 | 0 | 2 | 1 | |
| 5 | 6 | 4 | | | | | | |
| 20: | 2 | 3 | 6 | 2 | 5 | 3 | 6 | |
| 4 | 5 | 3 | | | | | | |
| 30: | 9 | 12 | 3 | 11 | 7 | 12 | 14 | |
| 22 | 16 | 16 | | | | | | |
| 40: | 9 | 26 | 30 | 45 | 42 | 52 | 48 | |
| 52 | 66 | 61 | | | | | | |
| 50: | 80 | 95 | 106 | 116 | 144 | 135 | 137 | |
| 120 | 145 | 148 | | | | | | |
| 60: | 157 | 167 | 213 | 232 | 244 | 201 | 157 | |
| 87 | 33 | 18 | | | | | | |
| 70: | 7 | 2 | 0 | 0 | 2 | 1 | 0 | |
| 0 | 2 | 1 | | | | | | |
| 80: | 0 | 3 | 3 | 4 | 2 | 3 | 5 | |
| 3 | 0 | 6 | | | | | | |
| 90: | 2 | 7 | 3 | 3 | 5 | 8 | 8 | |

238 U = 3364

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 100: | 12 | 7 | 8 | 8 | 4 | 2 | 6 |
| 4 | 2 | 0 | | | | | |
| 110: | 4 | 1 | 0 | 3 | 1 | 1 | 0 |
| 3 | 1 | 0 | | | | | |
| 120: | 2 | 2 | 0 | 3 | 2 | 4 | 4 |
| 5 | 0 | 4 | | | | | |
| 130: | 2 | 5 | 6 | 5 | 3 | 2 | 7 |
| 6 | 5 | 12 | | | | | |
| 140: | 9 | 6 | 10 | 14 | 13 | 10 | 8 |
| 13 | 13 | 12 | | | | | |
| 150: | 18 | 26 | 23 | 31 | 33 | 36 | 37 |
| 44 | 51 | 63 | | | | | |
| 160: | 78 | 82 | 94 | 108 | 137 | 122 | 143 |
| 164 | 174 | 175 | | | | | |
| 170: | 174 | 154 | 173 | 188 | 211 | 249 | 248 |
| 257 | 224 | 180 | | | | | |
| 180: | 82 | 40 | 15 | 7 | 2 | 5 | 4 |
| 5 | 1 | 1 | | | | | |
| 190: | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | | | | | |
| 200: | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 220: | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | | | | | |
| 230: | 1 | 1 | 0 | 1 | 7 | 0 | 2 |
| 1 | 3 | 1 | | | | | |
| 240: | 1 | 1 | 1 | 0 | 3 | 4 | 3 |
| 4 | 11 | 2 | | | | | |
| 250: | 7 | 3 | 5 | 7 | 6 | 6 | 11 |
| 8 | 15 | 11 | | | | | |
| 260: | 14 | 11 | 18 | 15 | 29 | 27 | 39 |
| 40 | 43 | 65 | | | | | |
| 270: | 66 | 61 | 86 | 118 | 103 | 103 | 81 |
| 86 | 94 | 110 | | | | | |
| 280: | 100 | 102 | 115 | 147 | 149 | 151 | 137 |
| 135 | 70 | 38 | | | | | |
| 290: | 13 | 8 | 4 | 3 | 1 | 3 | 2 |
| 0 | 1 | 0 | | | | | |
| 300: | 2 | 0 | 2 | 4 | 2 | 4 | 4 |
| 5 | 2 | 3 | | | | | |
| 310: | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | | | | | |
| 320: | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 330: | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | | | | | |
| 340: | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | | | | | |
| 350: | 0 | 1 | 0 | 0 | 2 | 1 | 1 |
| 2 | 1 | 0 | | | | | |
| 360: | 4 | 1 | 3 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | | | | | |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 390: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 400: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 410: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 420: | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 430: | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 440: | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 450: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | | | | | |
| 460: | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 470: | 0 | 1 | 0 | 3 | 1 | 0 | 0 |
| 2 | 3 | 1 | | | | | |
| 480: | 1 | 3 | 3 | 2 | 0 | 3 | 0 |
| 0 | 0 | 0 | | | | | |
| 490: | 0 | 0 | 0 | 0 | 0 | 0 | |

k0E

BWL
3/11/93

k0BMCB # 1 ACQ 03-08-93 AT 10:35:16 RT : 172060.2 LT : 172041.6
No detector description was entered
NOPI-ECP-17-sep4 Thorium caliche

Counting time = 2867.67 min

days between separation & counting = 5

ROI # 8-1 RANGE : 25 = 3.91MeV to 41 = 3.99MeV
AREA : Gross = 55 Net = 30 +/- 9
CENTROID : 36.30 = 3.97MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.03MeV

ID : Th-232 at 3.95MeV
Corrected Rate = 0.000 +/- 0.00

ROI # 8-2 RANGE : 134 = 4.50MeV to 173 = 4.71MeV
AREA : Gross = 8497 Net = 8458 +/- 93
CENTROID : 163.83 = 4.66MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.06MeV

ID : Th-230 at 4.69MeV
Corrected Rate = 0.049 +/- 0.00

ROI # 8-3 RANGE : 270 = 5.23MeV to 311 = 5.45MeV
AREA : Gross = 3524 Net = 3328 +/- 67
CENTROID : 303.78 = 5.42MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.05MeV

ID : Th-228 at 5.42MeV
Corrected Rate = 0.019 +/- 0.00

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10: | 1 | 1 | 0 | 0 | 0 | 0 | | 0 |
| 1 | 0 | 1 | | | | | | |
| 20: | 1 | 0 | 0 | 1 | 1 | 0 | 232Th = 55 | 1 |
| 1 | 1 | 1 | | | | | | |
| 30: | 2 | 2 | 0 | 2 | 5 | 7 | | 9 |
| 11 | 6 | 3 | | | | | | |
| 40: | 4 | 0 | 0 | 0 | 1 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 60: | 0 | 0 | 0 | 0 | 1 | 2 | | 1 |
| 0 | 1 | 0 | | | | | | |
| 70: | 0 | 0 | 0 | 2 | 0 | 0 | | 0 |
| 1 | 0 | 0 | | | | | | |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 90: | 2 | 0 | 1 | 1 | 0 | 0 | | 0 |
| 1 | 0 | 2 | | | | | | |
| 100: | 0 | 0 | 0 | 0 | 1 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 110: | 0 | 0 | 0 | 1 | 1 | 0 | | 0 |
| 0 | 2 | 0 | | | | | | |
| 120: | 1 | 2 | 0 | 1 | 1 | 4 | | 1 |
| 1 | 1 | 1 | | | | | | |
| 130: | 2 | 2 | 2 | 1 | 0 | 230Th = 8497 | 1 | 1 |
| 2 | 4 | 5 | | | | | | |
| 140: | 6 | 8 | 8 | 4 | 14 | | 21 | 39 |
| 81 | 116 | 197 | | | | | | |
| 150: | 251 | 301 | 353 | 236 | 171 | | 98 | 75 |
| 83 | 139 | 183 | | | | | | |
| 160: | 318 | 512 | 720 | 1044 | 1201 | | 1096 | 704 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 170: | 4 | 2 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 180: | 1 | 2 | 0 | 2 | 1 | 0 | 0 |
| 1 | 1 | 0 | | | | | |
| 190: | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 210: | 0 | 0 | 0 | 1 | 1 | 2 | 0 |
| 0 | 1 | 0 | | | | | |
| 220: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 1 | | | | | |
| 230: | 1 | 3 | 0 | 1 | 0 | 1 | 2 |
| 1 | 0 | 0 | | | | | |
| 240: | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 250: | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 3 | | | | | |
| 260: | 3 | 1 | 2 | 2 | 3 | 2 | 1 |
| 2 | 0 | 0 | | | | | |
| 270: | 0 | [2 | 2 | 3 | 0 | 2 | 2 |
| 0 | 4 | 3 | | | | | |
| 280: | 2 | 4 | 12 | 19 | 38 | 47 | 78 |
| 129 | 140 | 136 | | | | | |
| 290: | 108 | 62 | 29 | 19 | 17 | 12 | 23 |
| 33 | 50 | 83 | | | | | |
| 300: | 114 | 213 | 285 | 456 | 513 | 397 | 287 |
| 138 | 36 | 12 | | | | | |
| 310: | 11 | 1] | 0 | 4 | 2 | 1 | 2 |
| 0 | 1 | 0 | | | | | |
| 320: | 3 | 0 | 2 | 1 | 3 | 1 | 3 |
| 2 | 1 | 2 | | | | | |
| 330: | 1 | 1 | [1 | 3 | 1 | 3 | 2 |
| 5 | 4 | 4 | | | | | |
| 340: | 7 | 5 | 4 | 3 | 3 | 9 | 10 |
| 15 | 17 | 27 | | | | | |
| 350: | 49 | 70 | 86 | 112 | 114 | 84 | 56 |
| 38 | 21 | 10 | | | | | |
| 360: | 13 | 7 | 5] | 9 | 7 | 10 | 11 |
| 12 | 16 | 8 | | | | | |
| 370: | 11 | 2 | 2 | 1 | 2 | 2 | 1 |
| 2 | 0 | 1 | | | | | |
| 380: | 1 | 0 | 3 | 4 | 1 | 3 | 4 |
| 0 | 2 | 0 | | | | | |
| 390: | 1 | 2 | 1 | 1 | 3 | 0 | 3 |
| 1 | 1 | 1 | | | | | |
| 400: | 1 | 3 | 1 | 5 | 6 | 11 | 12 |
| 10 | 16 | 19 | | | | | |
| 410: | 18 | 8 | 9 | 3 | 7 | 7 | 9 |
| 7 | 11 | 21 | | | | | |
| 420: | 25 | 25 | 16 | 23 | 12 | 9 | 9 |
| 4 | 10 | 8 | | | | | |
| 430: | 2 | 4 | 6 | 3 | 6 | 2 | 1 |
| 3 | 3 | 2 | | | | | |
| 440: | 1 | 1 | 2 | 0 | 2 | 0 | 1 |
| 1 | 1 | 1 | | | | | |
| 450: | 0 | 3 | 3 | 2 | 5 | 7 | 8 |
| 2 | 5 | 2 | | | | | |
| 460: | 10 | 10 | 26 | 34 | 56 | 59 | 73 |
| 84 | 79 | 61 | | | | | |
| 470: | 43 | 27 | 9 | 5 | 1 | 3 | 0 |
| 2 | 1 | 1 | | | | | |
| 480: | 2 | 1 | 2 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 490: | 1 | 2 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |

228Th = 3524

224Ra = 787

```
500:        58        78        79        78        79        78        83
   92        78        83
510:        74        29         0         0         0         0         0
    0         0         0
520:         0         0
k0G
```

2/23/93
PJF

NOPI-ECP-17-SEP2 was powdered in the SPEX mixer mill. The gamma spectrometry sample was then prepared and labeled NOPI-ECP-17-Sep2-GAM

vial wt 2.0735
Sample + Vial 5.9918
3.9183 g

2/24/93
BWL

Prior to dating NOPI-ECP-17 caliche sample I will dry powders in crucible @ 100°C for 24 hours

| | | | |
|---|---|---|---|
| Crucible 1 | 43.9811 | wt + sample | wt+sample dry 43.8271 |
| NOPI-ECP-17-SEP1 | 30.8312 | wt | |
| | 13.1499 | sample wt (g) | dry sample wt (g) = 12.9959 |
| Crucible 4 | 36.0469 | wt + sample | wt + sample dry 36.0387 |
| NOPI-ECP17-SEP4 | 31.9049 | wt | |
| | 4.142 | sample wt (g) | dry sample wt (g) = 4.1338 |
| Crucible 2 | | | |
| NOPI-ECP-17-SEP2 | 46.9185 | wt + sample | wt+sample dry 46.7038 |
| | 30.8775 | wt | |
| | 16.041 | sample wt (g) | dry sample wt (g) = 15.8263 |

BWL
2/25/93
Prior to Ashing @ 900°C for 4 hours in crucible 1, 2, 4

#4: 32.1580 sample + vial; 31.9049 g empty; 0.2531 g wt sample

#1: 31.2541 vial + sample; 30.8330 g empty; 0.4211 g wt sample

#2: 31.1010 sample + crucible; 30.8782 g empty; 0.2228 g wt sample

2 4
in furnace
in at 900°C 13:30 → 19:00

2/26/93 BWL

Crucible #1 31.1330 #2 31.0380 #4 32.1330

After Ashing

"CaO"

wt of sample after Ashing #1 0.301 g #2 0.1598 g #4 0.2281 g

g $CO_2$ evolved (eg #1 .4211 - 0.301) 0.1201 0.063 0.025

g $CaCO_3$ (eg #1 $(.1201)\left(\frac{100 \text{ g mole } CaCO_3}{44 \text{ g/mole } CO_2}\right)$) 0.2730 0.1432 0.0568

% $CaCO_3$ 64.83 64.27 22.44

g residue = g sample - g $CaCO_3$ 0.1481 0.0796 0.1963

% wt loss (eg $\frac{.4211 - .301}{.4211} \times 100\%$) 28.52% 28.28% 9.87

to neutralize

$(\text{g CaO})\left(\frac{\text{mole}}{56.0794 \text{ g}}\right)\left(2 \frac{\text{mol } OH^-}{1 \text{ mol}}\right) =$

added 0.075 L 0.1 N $HNO_3$

#1 0.0107 mole $OH^-$ #2 0.0057 mole $OH^-$ #4 0.00813

mole $H^+$ 0.0075 0.0075 0.0075

mole OH 0.0032 -0.0018 0.00063

to pH 7 0.2 ml .04 ml

to pH 1 conc 6 ml 6 ml 6 ml

2/26/93 BWL Samples NOPI-ECP-17-SEP1 2, 4 were taken to dryness and 50ml HF and 5ml $HClO_4$ were added
Lots 904984 & 913360.

Samples taken to dryness and an additional 50 ml HF & 5 ml $HClO_4$ were added. Teflon watch glass used to cover samples and samples will be cooked for 6 hours covered.

2/27/93 BWL Samples taken to dryness.

3/1/93 BWL NOPI-ECP-28.3/13.0-WR-GAM prepared for powdered whole rock sample NOPI-ECP-28.3/13.0.

| | |
|---|---|
| vial + sample | 6.1979 |
| vial | 2.0771 |
| | 4.1208 g = sample wt |

a Total of 60 ml of aqua regia added to each NOPI-ECP-17 sample and gently heated.
Lots # FL-02-0786 & FL-04-0390
The aqua regia was allowed to react and then the solutions were evaporated to ~20 ml remaining. Sides of beaker carefully washed w/ DIW (nanopure $H_2O$).

The samples are ready to be spiked! Spike # 17A-1A which is ≈ 22.70 dpm/g of $^{232}U$ ~8 dpm/g $^{228}Th$.
to gamma analysis of NOPI-ECP-17-SEP2-GAM indicate 160 dpm/g.
Thus

| | SEP1 | SEP2 | SEP4 |
|---|---|---|---|
| | .4211 g | .2228 g | .2531 g |
| wt 17A-1A to be used | ~3.0 g | ~1.6 g | ~1.8 g |

3/1/93 A portion of the whole rock powder was removed,
pgl Oil was added, and an XRD slide was prepared
for the following samples

NOP1-ECP · 28.3/13.0 - XRD1
NOP1-ECP · 9.95/13.51 - XRD1
NOP1 · ECP · 9.95/13.48 XRD1
NOP1 · ECP · 10 · XRD1
NOP1 · ECP · 9.95/13.55 · XRD1

3/1/93 BWL

NOP1-ECP-17-SEP1 boat + spike 3.2781
(3) boat .4987
2.7794 g 17A-1A

NOP1-ECP-17-SEP2 boat + spike 2.3964
(1.6) boat .5081
1.8883 g 17A-1A

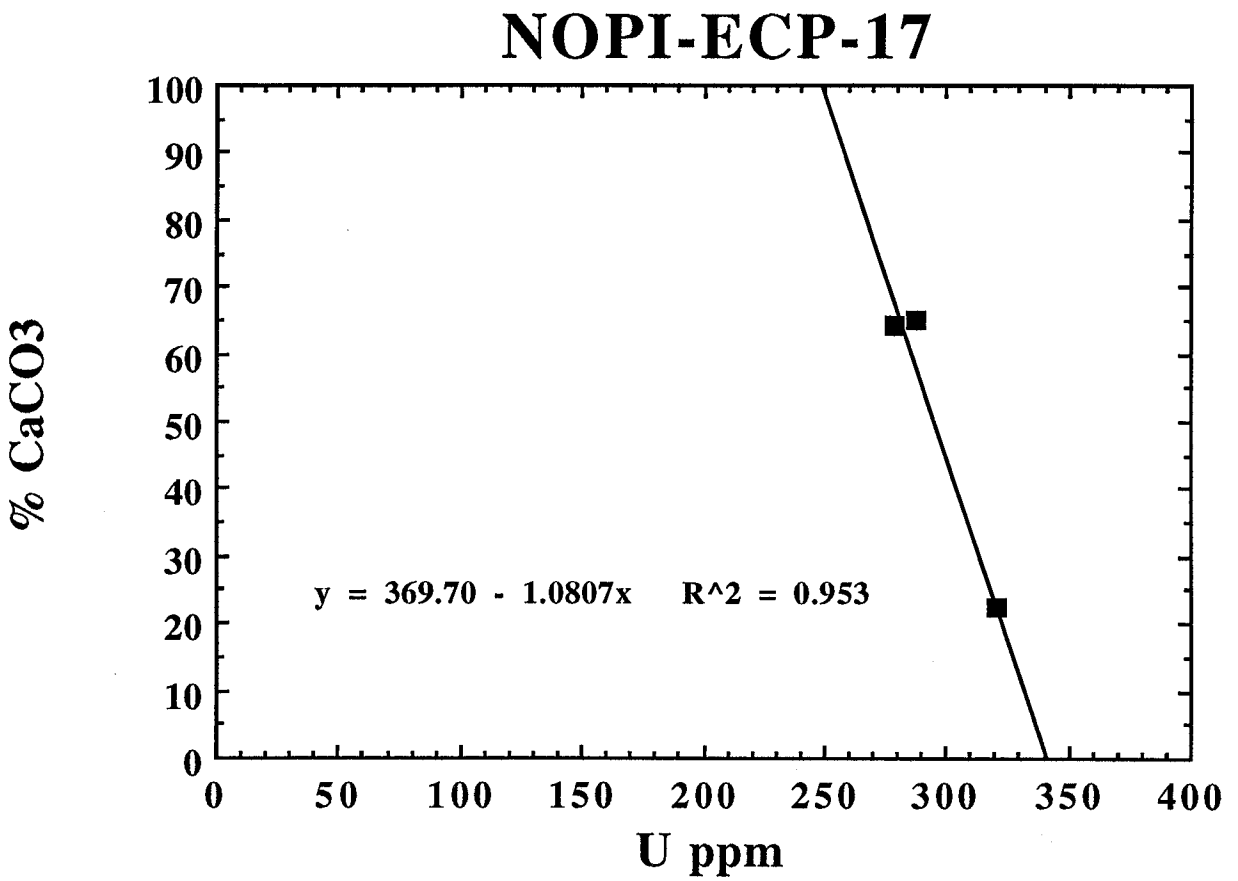
NOP1-ECP-17-SEP4 boat + spike 2.4671
(1.8) boat .5118
1.9553 g 17A-1A

Total of 6.62 grams of 17A-1A used.

The spiked solutions will be gently heated to equilibrate samples.

carb,u data Fri, May 21, 1993 3:16 PM

| | %caco3 | U ppm | Size frac micron |
|---|---|---|---|
| 1 | 64.830 | 287.430 | x > 1000 |
| 2 | 64.270 | 278.437 | 1000 > x > 250 |
| 3 | 22.440 | 320.176 | 125 > x > 63 |


NOPI-ECP-17
% CaCO3
U ppm
y = 369.70 - 1.0807x R^2 = 0.953
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300
350
400

$CaCO_3$ = 250 ppm U

6/30/92
JMG

Sample rock NOP1-ECP-17 which is made of caliche was smashed into tiny sandlike grains. Then the smashed sample was placed in a sieve series to obtain five different sizes of caliche grains. The new samples with the grain size are as follows:

| New name | size (mm) |
|---|---|
| NOP1-ECP-17-SEP1 | >1.00 mm |
| wt. vial + sample | 19.8578 g |
| wt. vial | 5.1140 g |
| wt. sample | 14.7438 g |

| | | |
|---|---|---|
| NOP1-ECP-17-SEP2 | >0.250 mm | |
| wt. vial + sample | ~~13.8242 g~~ JMG 6/30/92 | 32.3252 g |
| wt. vial | ~~5.5975 g~~ | 11.0026 g |
| wt. sample | | 21.3226 g |

| | | |
|---|---|---|
| | JMG 6/30/92 | |
| NOP1-ECP-17-SEP3 | ~~>0.063 mm~~ | >0.125 mm |
| wt. vial + sample | ~~12.7939 g~~ | 13.8242 g |
| wt. vial | ~~5.1781 g~~ | 5.5975 g |
| wt. sample | | 8.2267 g |

| | |
|---|---|
| NOP1-ECP-17-SEP4 | >0.063 mm |
| wt. vial + sample | 12.7939 g |
| wt. vial | 5.1781 g |
| wt. sample | 7.6158 g |

| | |
|---|---|
| NOP1-ECP-17-SEP5 | =< 0.063 mm |
| wt. vial + sample | 8.6116 g |
| wt. vial | 6.8264 g |
| wt. sample | 1.7852 g |

Sample NOP1-ECP-11 which contains $Fe_2O_3$ and $Fe(OH)_3$ was scratched to obtain JMG 6/30/92 ~~compo~~ both compounds seperately. The new names and weights are in the following page.

## MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES

sample # **92-3/BH-12 #41** Sep. date **2/2/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 712.66 | 0.4246 | 22.58 | 12/27/92 | 37 | *22.55699* |

Th228/U232 *0.359*

Counting time for Th = 11365.15 (min.)
Days btwn. sep. & count. = 1 (days)
*CF for Th-228* = *.9951*

Counting time for U = 2247.893 (min.)
Days btwn. sep. & count. = 7 (days)
*CF for U-232* = *1.0075*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 7 | 65 | 2378 | 979 |
| bkgd | bkgd | bkgd | bkgd |
| 0.0001 | 0.00048 | 0.00504 | 0.00096 |

bkgd time 1 (min.)

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 132 | 356 | 1438 |
| bkgd | bkgd | bkgd |
| 0.00024 | 0.0001 | 0.00312 |

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *5.863485* | *59.544729* | *2274.7097* | *968.089* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *131.4605* | *355.775* | *1420.4* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **1.24E-03** | ± | **1.13E-04** |
| U-234(dpm/g) = | **3.37E-03** | ± | **1.99E-04** |
| Th-232(dpm/g) = | **1.24E-05** | ± | **4.71E-06** |
| Th-230(dpm/g) = | **1.26E-04** | ± | **1.59E-05** |
| U-234/U-238 = | **2.7063** | ± | **0.2758** |
| Th-230/U-234 = | **0.0375** | ± | **0.0051** |
| Th-230/Th-232 = | **10.1552** | ± | **4.0397** |
| U-234/Th-232 = | **270.6768** | ± | **103.7021** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

| | | | |
|---|---|---|---|
| **U (ppb) =** | **1.667** | ± | **0.152** |
| **Th (ppb) =** | **0.051** | ± | **0.019** |

OCL THE FOLLOWING WATER SAMPLES (SIX) HAVE BEEN STORED IN THE REFRIGERATOR. THEY WERE TAKEN OUT AND ALLOWED TO REACH ROOM TEMPERATURE. THE SAMPLES WERE WEIGHED ON A TOP LOADING BALANCE.

2/12/93
SWL

| | SAMPLE I.D. | Weight Sample | WEIGHT BOTTLE + SAMPLE | Dry EMPTY Bottle |
|---|---|---|---|---|
| ① | EM-1-1 | 169.72 | 225.61 g | 55.89 |
| ② | EM-1-2 | 873.67 | 978.40 g | 104.73 |
| ③ | BH-12-1 | 103.47 | 160.43 g | 56.96 |
| ④ | BH-12-2 | 471.03 | 576.67 g | 105.64 |
| ⑤ | 92-31 BH-12 * 41 | 712.66 | 817.50 g | 104.84 |
| ⑥ | 92-31 BH-12 * 42 | 617.28 | 720.40 g | 103.12 |

4:00PM AFTER WEIGHING, EACH SAMPLE IS SPIKED WITH URANIUM SAMPLE #17A-1A. Approximately 0.40 g OF SPIKE IS WEIGHED ON A WEIGHING BOAT AND TRANSFERRED INTO THE SAMPLE SOLUTION. THE WEIGHING BOAT IS THEN RINSED WITH 0.1 $HNO_3$ TO ENSURE THAT ALL THE SPIKE IS TRANSFERRED. Next, Approximately 20 mg OF Fe carrier ARE ADDED TO EACH SAMPLE USING A CLEAN PASTUER PIPET. THE SOLUTIONS ARE THEN ALLOWED TO EQUILIBRATE FOR 24 HOURS. THE FOLLOWING DATA SHOWS THE MASS OF SPIKE USED IN EACH SAMPLE AND THE TOTAL MASS USED.

| | SPIKE USED |
|---|---|
| EM-1-1 | .4209 g |
| EM-1-2 | .4212 g |

| | |
|---|---|
| BH-12-1 | .4283 g |
| BH-12-2 | .4318 g |
| 92-3/BH-12 * 41 | .4246 g |
| 92-3/BH-12 * 42 | .4286 g |
| TOTAL USED : | 2.5554 g |

92-3/BH-12 Uranium 2/12/93

Lt = 1348736 sec

Lt = 2247.893 minutes

MCB # 1 ACQ 02-10-93 AT 17:36:09 RT : 134875.0 LT : 134873.6
No detector description was entered
BH-12 3/92 #41 Recount U

ROI # 7-1 RANGE : 68 = 4.11MeV to 87 = 4.21MeV
AREA : Gross = 132 Net = 93 +/- 14
CENTROID : 81.98 = 4.18MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.04MeV

ROI # 7-2 RANGE : 172 = 4.66MeV to 195 = 4.79MeV
AREA : Gross = 356 Net = 260 +/- 23
CENTROID : 189.49 = 4.76MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.05MeV

ROI # 7-3 RANGE : 270 = 5.19MeV to 299 = 5.35MeV
AREA : Gross = 1438 Net = 1378 +/- 40
CENTROID : 291.08 = 5.30MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.10MeV

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 69: | 2 | | | | | | | | | |
| 70: | 1 | 1 | 6 | 4 | 8 | 1 | 5 | 3 | 5 | 6 |
| 80: | 10 | 23 | 18 | 21 | 10 | 4 | 1 | 1 | 0 | 0 |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110: | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 120: | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| 160: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 170: | 1 | 0 | 2 | 1 | 2 | 3 | 5 | 7 | 9 | 11 |
| 180: | 14 | 13 | 17 | 12 | 7 | 12 | 13 | 26 | 38 | 42 |
| 190: | 41 | 37 | 25 | 11 | 6 | 2 | 8 | 7 | 14 | 9 |
| 200: | 8 | 6 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 220: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 230: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 240: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 250: | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| 260: | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 0 |
| 270: | 1 | 3 | 2 | 3 | 8 | 1 | 8 | 15 | 24 | 47 |
| 280: | 70 | 65 | 58 | 59 | 31 | 33 | 31 | 51 | 69 | 120 |
| 290: | 153 | 175 | 166 | 120 | 77 | 31 | 11 | 5 | 1 | 0 |
| 300: | 1 | 1 | 3 | 1 | 1 | 0 | 0 | 1 | 4 | 3 |
| 310: | 5 | 9 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 0 |
| 320: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 330: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 340: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 350: | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 1 | 4 | 1 |
| 360: | 3 | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 380: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 410: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 420: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| -40: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50: | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 60: | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | [2 | 2 |
| 70: | 1 | 1 | 6 | 4 | 8 | 1 | 5 | 3 | 5 | 6 |
| 80: | 10 | 23 | 18 | 21 | 10 | 4 | 1 | 1] | 0 | 0 |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110: | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 120: | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| 160: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 170: | 1 | 0 | [2 | 1 | 2 | 3 | 5 | 7 | 9 | 11 |
| 180: | 14 | 13 | 17 | 12 | 7 | 12 | 13 | 26 | 38 | 42 |
| 190: | 41 | 37 | 25 | 11 | 6 | 2] | 8 | 7 | 14 | 9 |
| 200: | 8 | 6 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 220: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 230: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 240: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 250: | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| 260: | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 0 |
| 270: | [1 | 3 | 2 | 3 | 8 | 1 | 8 | 15 | 24 | 47 |
| 280: | 70 | 65 | 58 | 59 | 31 | 33 | 31 | 51 | 69 | 120 |
| 290: | 153 | 175 | 166 | 120 | 77 | 31 | 11 | 5 | 1] | 0 |
| 300: | 1 | 1 | 3 | 1 | 1 | 0 | 0 | 1 | 4 | 3 |
| 310: | 5 | 9 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 0 |
| 320: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 330: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 340: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 350: | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 1 | 4 | 1 |
| 360: | 3 | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 380: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 410: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 420: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 430: | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 440: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 450: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 460: | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 1 |
| 470: | 1 | 1 | | | | | | | | |

238 U

= 132

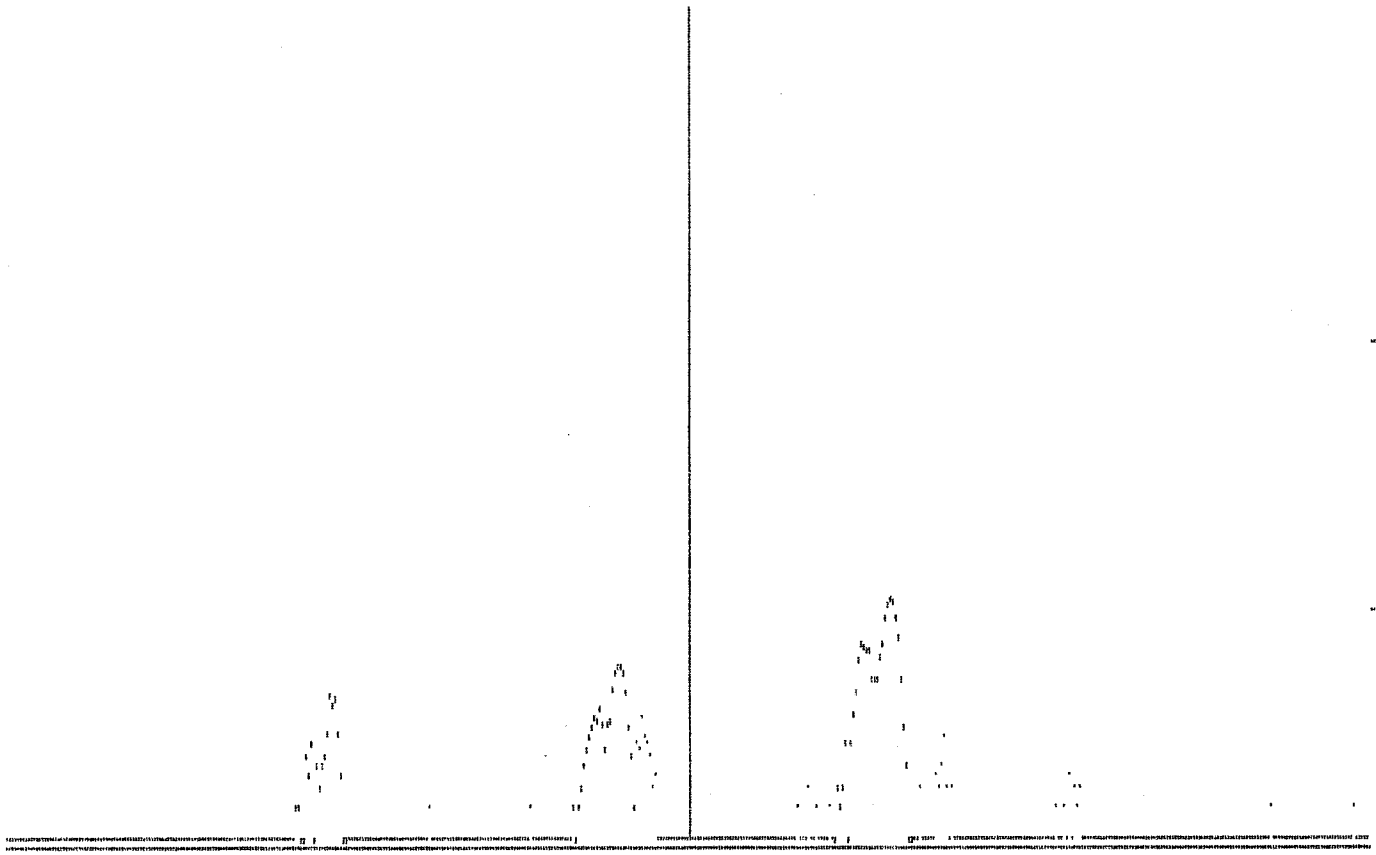
234

U = 356

232 U = 1438

Maestro II - a:92341ua.chn

Files Calculate Services ROI Presets Acquire Display



Display
MCB/Buffer
MCB# 1 Seg# 7
Full/Expand
Vt : Log
Hz : 512
ROI : Off

Presets
Rl Tm
Lv Tm
ROI Cnt
ROI Int

Time
Rl Tm 134875
Lv Tm 134873
Dead Tm 0.0%
02-12-93
07:34:43
EG&G ORTEC

Marker: 216 = 4.901 MeV Counts: 0

Printing complete.

2/12/93
BWL

Lt = 249920.8 sec
Lt = 4165.347 minutes

```
MCB # 1      ACQ 01-30-93  AT 10:58:33   RT : 249958.3   LT : 249920.8
             No detector description was entered
             BAckground # 7  2/3/93

ROI #  7-1   RANGE :   68 =    4.11MeV  to   86 =    4.20MeV
             AREA : Gross = 1         Net = 0          +/- 1
             Could not properly fit the peak.

ROI #  7-2   RANGE :  171 =    4.66MeV  to  194 =    4.78MeV
             AREA : Gross = 0         Net = 0          +/- 0
             Could not properly fit the peak.

ROI #  7-3   RANGE :  271 =    5.20MeV  to  300 =    5.35MeV
             AREA : Gross = 12        Net = 12         +/- 3
             Could not properly fit the peak.
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30: | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 40: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60: | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | [0 | 0 |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0] | 0 | 0 |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 120: | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 160: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 170: | 0 | 0 | [0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 180: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 190: | 0 | 0 | 0 | 0 | 0 | 0] | 0 | 0 | 0 | 0 |
| 200: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 220: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 230: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 240: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 250: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 260: | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 270: | [1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 280: | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 290: | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0] |
| 300: | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 2 | 2 | 2 |
| 310: | 4 | 3 | 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 320: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 330: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 340: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 |
| 350: | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 2 | 4 | 4 |
| 360: | 3 | 3 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 410: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 420: | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 430: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 440: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 450: | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 460: | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 2 | 0 | 0 |
| 470: | 1 | 2 | 4 | 2 | 2 | 1 | 0 | 0 | 1 | 1 |
| 480: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 490: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 500: | 4 | 0 | 1 | 6 | 0 | 0 | 4 | 3 | 3 | 3 |
| 510: | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 520: | 0 | 0 | 0 | 0 | | | | | | |

= 1

= .00024

= 0

.0001

= 13

⇒ 0.00312

MCB # 1 ACQ 02-03-93 AT 08:56:30 RT : 525975.6 LT : 525966.4
No detector description was entered
92-3/BH-12*41 U

ROI # 7-1 RANGE : 66 to 88
AREA : Gross = 419 Net = 338 +/- 24
CENTROID : 82.56
SHAPE : Fwhm = 6.48 Channels Fwtm = 14.23 Channels

ROI # 7-2 RANGE : 164 to 194
AREA : Gross = 1177 Net = 418 +/- 60
CENTROID : 189.50
SHAPE : Fwhm = 4.36 Channels Fwtm = 6.21 Channels

ROI # 7-3 RANGE : 269 to 298
AREA : Gross = 4704 Net = 4449 +/- 74
CENTROID : 290.51
SHAPE : Fwhm = 5.59 Channels Fwtm = 18.44 Channels

MCB # 1 ACQ 02-03-93 AT 08:56:30 RT : 525975.6 LT : 525966.4
No detector description was entered
92-3/BH-12*41 U

ROI # 7-1 RANGE : 30 to 88
AREA : Gross = 492 Net = 256 +/- 48
CENTROID : 82.63
SHAPE : Fwhm = 6.43 Channels Fwtm = 11.74 Channels

ROI # 7-2 RANGE : 135 to 194
AREA : Gross = 1425 Net = -65 +/- 116
CENTROID : 189.68
SHAPE : Fwhm = 4.44 Channels Fwtm = 5.90 Channels

ROI # 7-3 RANGE : 223 to 298
AREA : Gross = 5682 Net = 5150 +/- 107
CENTROID : 290.52
SHAPE : Fwhm = 5.59 Channels Fwtm = 18.38 Channels

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -19: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| 10: | 0 | 0 | 1 | 2 | 2 | 0 | 1 | 2 | 0 | 1 | | |
| 20: | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | | |
| 30: | 4 | 1 | 3 | 2 | 1 | 4 | 3 | 2 | 3 | 2 | | |
| 40: | 1 | 2 | 1 | 6 | 2 | 4 | 2 | 4 | 2 | 3 | | |
| 50: | 5 | 3 | 3 | 3 | 0 | 1 | 0 | 1 | 0 | 1 | | |
| 60: | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 4 | 5 | | |
| 70: | 4 | 4 | 9 | 17 | 9 | 13 | 15 | 15 | 17 | 29 | | |
| 80: | 35 | 36 | 51 | 58 | 45 | 36 | 12 | 2 | 2 | 0 | | |
| 90: | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | | |
| 100: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | | |
| 110: | 2 | 0 | 1 | 1 | 2 | 2 | 0 | 1 | 4 | 4 | | |
| 120: | 1 | 3 | 5 | 2 | 0 | 4 | 3 | 1 | 3 | 1 | | |
| 130: | 3 | 1 | 5 | 1 | 0 | 3 | 1 | 4 | 3 | 6 | | |
| 140: | 7 | 7 | 4 | 11 | 10 | 10 | 10 | 13 | 8 | 10 | | |
| 150: | 13 | 6 | 12 | 12 | 28 | 8 | 13 | 13 | 8 | 9 | | |
| 160: | 7 | 6 | 3 | 3 | 1 | 2 | 3 | 2 | 5 | 0 | | |
| 170: | 1 | 3 | 2 | 2 | 8 | 8 | 18 | 18 | 31 | 48 | | |
| 180: | 36 | 45 | 34 | 37 | 34 | 35 | 52 | 93 | 107 | 138 | | |
| 190: | 151 | 122 | 79 | 41 | 21 | 14 | 28 | 27 | 32 | 41 | | |
| 200: | 29 | 21 | 12 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | | |
| 210: | 0 | 3 | 0 | 1 | 0 | 1 | 1 | 0 | 3 | 4 | | |
| 220: | 5 | 2 | 0 | 2 | 2 | 3 | 1 | 3 | 9 | 9 | | |
| 230: | 5 | 4 | 6 | 12 | 12 | 13 | 19 | 18 | 14 | 14 | | |
| 240: | 13 | 14 | 17 | 19 | 26 | 23 | 31 | 29 | 21 | 31 | | |
| 250: | 22 | 38 | 29 | 40 | 39 | 45 | 39 | 46 | 48 | 50 | | |
| 260: | 50 | 37 | 30 | 24 | 22 | 20 | 10 | 16 | 3 | 2 | | |
| 270: | 9 | 5 | 12 | 14 | 17 | 34 | 39 | 67 | 105 | 166 | | |
| 280: | 212 | 213 | 185 | 143 | 114 | 102 | 128 | 216 | 291 | 403 | | |
| 290: | 526 | 560 | 492 | 357 | 177 | 80 | 31 | 3 | 1 | 2 | | |
| 300: | 3 | 3 | 1 | 0 | 1 | 3 | 2 | 6 | 12 | 8 | | |
| 310: | 10 | 13 | 6 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | | |
| 320: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 330: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| 340: | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | | |
| 350: | 0 | 0 | 1 | 3 | 1 | 1 | 5 | 3 | 7 | 8 | | |
| 360: | 8 | 5 | 3 | 1 | 4 | 1 | 2 | 0 | 1 | 0 | | |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 410: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 420: | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 4 | 2 | | |
| 430: | 0 | 1 | 0 | 1 | 4 | 1 | 0 | 0 | 2 | 2 | | |
| 440: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 450: | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | | |
| 460: | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 3 | 3 | | |
| 470: | 2 | 7 | 9 | 2 | 4 | 2 | 1 | 1 | 1 | 1 | | |
| 480: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 490: | 0 | 0 | 0 | | | | | | | | | |

92-3/BH-12 Th

2/12/93
BWL

LT = 681908.9 sec

LT = 11 365.148 minutes

MCB # 1 ACQ 02-03-93 AT 08:55:53 RT : 681919.7 LT : 681908.9
No detector description was entered
BH-12 #41 Th 3/92 Pena Blanca Nopal I

ROI # 8-1 RANGE : 29 = 3.93MeV to 41 = 3.99MeV
AREA : Gross = 7 Net = -3 +/- 3
Could not properly fit the peak.

ROI # 8-2 RANGE : 146 = 4.56MeV to 167 = 4.68MeV
AREA : Gross = 65 Net = 14 +/- 12
Could not properly fit the peak.

ROI # 8-3 RANGE : 233 = 5.03MeV to 311 = 5.45MeV
AREA : Gross = 2378 Net = 1815 +/- 93
CENTROID : 302.27 = 5.41MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.07MeV

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -34: | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 8 | | | |
| -10: | 10 | 10 | 7 | 6 | 10 | 11 | 9 | 6 | 12 | 2 | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 10: | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | | |
| 20: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 30: | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | | | |
| 40: | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 60: | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | | |
| 70: | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | | | |
| 80: | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 90: | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | | | |
| 100: | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | | | |
| 110: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 120: | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | | | |
| 130: | 0 | 0 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | | | |
| 140: | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | | | |
| 150: | 3 | 3 | 0 | 3 | 4 | 0 | 0 | 1 | 0 | 3 | | | |
| 160: | 5 | 8 | 5 | 12 | 4 | 7 | 2 | 3 | 0 | 2 | | | |
| 170: | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | |
| 180: | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 1 | | | |
| 190: | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | | | |
| 210: | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 2 | 1 | 1 | | | |
| 220: | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 2 | 1 | 1 | | | |
| 230: | 1 | 2 | 0 | 3 | 3 | 6 | 5 | 0 | 2 | 1 | | | |
| 240: | 7 | 4 | 3 | 5 | 4 | 4 | 3 | 3 | 8 | 1 | | | |
| 250: | 8 | 10 | 8 | 9 | 4 | 12 | 9 | 8 | 9 | 10 | | | |
| 260: | 11 | 13 | 9 | 10 | 10 | 14 | 12 | 15 | 21 | 10 | | | |
| 270: | 18 | 13 | 15 | 17 | 21 | 21 | 15 | 16 | 11 | 8 | | | |
| 280: | 14 | 15 | 26 | 29 | 39 | 37 | 49 | 54 | 49 | 53 | | | |
| 290: | 29 | 25 | 30 | 18 | 22 | 35 | 35 | 52 | 73 | 105 | | | |
| 300: | 131 | 167 | 190 | 202 | 173 | 143 | 68 | 35 | 20 | 14 | | | |
| 310: | 9 | 8 | 11 | 4 | 13 | 13 | 3 | 11 | 7 | 9 | | | |
| 320: | 15 | 11 | 11 | 10 | 15 | 9 | 8 | 5 | 4 | 4 | | | |
| 330: | 2 | 3 | 4 | 8 | 6 | 2 | 4 | 4 | 6 | 7 | | | |
| 340: | 11 | 9 | 13 | 12 | 14 | 24 | 28 | 22 | 55 | 70 | | | |
| 350: | 95 | 108 | 137 | 133 | 87 | 75 | 34 | 18 | 7 | 1 | | | |
| 360: | 3 | 0 | 1 | 1 | 1 | 4 | 2 | 1 | 1 | 0 | | | |

$^{232}$Th = 7

$^{230}$Th = 65

$^{228}$Th = 2378

$^{224}$Ra = 979

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -34: | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 8 | | | |
| -10: | 10 | 10 | 7 | 6 | 10 | 11 | 9 | 6 | 12 | 2 | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 10: | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | | |
| 20: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 30: | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | | | |
| 40: | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 60: | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | | |
| 70: | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | | | |
| 80: | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 90: | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | | | |
| 100: | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | | | |
| 110: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | | |
| 120: | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | | | |
| 130: | 0 | 0 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | | | |
| 140: | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | | | |
| 150: | 3 | 3 | 0 | 3 | 4 | 0 | 0 | 1 | 0 | 3 | | | |
| 160: | 5 | 8 | 5 | 12 | 4 | 7 | 2 | 3 | 0 | 2 | | | |
| 170: | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | |
| 180: | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 1 | | | |
| 190: | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | | | |
| 210: | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 2 | 1 | 1 | | | |
| 220: | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 2 | 1 | 1 | | | |
| 230: | 1 | 2 | 0 | 3 | 3 | 6 | 5 | 0 | 2 | 1 | | | |
| 240: | 7 | 4 | 3 | 5 | 4 | 4 | 3 | 3 | 8 | 1 | | | |
| 250: | 8 | 10 | 8 | 9 | 4 | 12 | 9 | 8 | 9 | 10 | | | |
| 260: | 11 | 13 | 9 | 10 | 10 | 14 | 12 | 15 | 21 | 10 | | | |
| 270: | 18 | 13 | 15 | 17 | 21 | 21 | 15 | 16 | 11 | 8 | | | |
| 280: | 14 | 15 | 26 | 29 | 39 | 37 | 49 | 54 | 49 | 53 | | | |
| 290: | 29 | 25 | 30 | 18 | 22 | 35 | 35 | 52 | 73 | 105 | | | |
| 300: | 131 | 167 | 190 | 202 | 173 | 143 | 68 | 35 | 20 | 14 | | | |
| 310: | 9 | 8 | 11 | 4 | 13 | 13 | 3 | 11 | 7 | 9 | | | |
| 320: | 15 | 11 | 11 | 10 | 15 | 9 | 8 | 5 | 4 | 4 | | | |
| 330: | 2 | 3 | 4 | 8 | 6 | 2 | 4 | 4 | 6 | 7 | | | |
| 340: | 11 | 9 | 13 | 12 | 14 | 24 | 28 | 22 | 55 | 70 | | | |
| 350: | 95 | 108 | 137 | 133 | 87 | 75 | 34 | 18 | 7 | 1 | | | |
| 360: | 3 | 0 | 1 | 1 | 1 | 4 | 2 | 1 | 1 | 0 | | | |
| 370: | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | | | |
| 380: | 2 | 0 | 3 | 4 | 0 | 2 | 3 | 0 | 1 | 5 | | | |
| 390: | 4 | 4 | 1 | 3 | 0 | 4 | 5 | 1 | 2 | 2 | | | |
| 400: | 3 | 1 | 3 | 2 | 0 | 2 | 5 | 6 | 2 | 8 | | | |
| 410: | 1 | 1 | 6 | 5 | 6 | 16 | 7 | 10 | 21 | 22 | | | |
| 420: | 23 | 26 | 28 | 19 | 16 | 25 | 25 | 20 | 17 | 13 | | | |
| 430: | 18 | 8 | 14 | 12 | 12 | 11 | 13 | 16 | 9 | 11 | | | |
| 440: | 7 | 10 | 5 | 4 | 11 | 4 | 3 | 2 | 7 | 6 | | | |
| 450: | 10 | 4 | 4 | 7 | 7 | 15 | 18 | 14 | 18 | 30 | | | |
| 460: | 30 | 45 | 53 | 73 | 91 | 85 | 98 | 102 | 77 | 57 | | | |
| 470: | 42 | 15 | 11 | 2 | 1 | 2 | 2 | 1 | | | | | |

Background #8

2/12/93
BWL

LT = 249896.3 sec

LT = 4164.938 min

```
MCB # 1      ACQ 01-30-93  AT 10:58:57   RT : 249933.8   LT : 249896.3
             No detector description was entered
             Background # 8 2/3/93

ROI #  8-1   RANGE :   30 =    3.94MeV  to   42 =    4.00MeV
             AREA : Gross = 0         Net = 0          +/- 0
             Could not properly fit the peak.

ROI #  8-2   RANGE :  147 =    4.57MeV  to  168 =    4.68MeV
             AREA : Gross = 2         Net = 2          +/- 1
             Could not properly fit the peak.

ROI #  8-3   RANGE :  233 =    5.03MeV  to  310 =    5.45MeV
             AREA : Gross = 20        Net = -19        +/- 21
             Could not properly fit the peak.
```

```
MCB # 1      ACQ 02-12-93  AT 07:22:25   RT : 286040.9   LT : 286022.6
             No detector description was entered
             BH-12 3/92 #41 Recount U

ROI #  7-1   RANGE :    1 =    3.75MeV  to    1 =    3.75MeV
             AREA : Gross = 0         Net area not defined.
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100: | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 110: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 160: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 170: | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 180: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 190: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 200: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 220: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 230: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 240: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 250: | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 260: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 270: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 280: | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 290: | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 3 | 1 |
| 300: | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 0 | 7 | 2 |
| 310: | 7 | 6 | 6 | 3 | 4 | 2 | 1 | 0 | 0 | 0 |
| 320: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 330: | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 340: | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 350: | 0 | 0 | 0 | 1 | 1 | 2 | 4 | 2 | 2 | 2 |
| 360: | 3 | 8 | 5 | 7 | 0 | 0 | 1 | 0 | 1 | 0 |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 380: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 410: | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 420: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 430: | 0 | 1 | 2 | 4 | 1 | 1 | 0 | 1 | 1 | 0 |
| 440: | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 450: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 460: | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 0 | 3 |
| 470: | 2 | 1 | 5 | 8 | 2 | 5 | 2 | 4 | 1 | 0 |
| 480: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 490: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 500: | 4 | 6 | 4 | 9 | 9 | 1 | 6 | 9 | 4 | 8 |
| 510: | 2 | 2 | 0 | | | | | | | |

```
MCB # 1       ACQ 02-12-93  AT 07:22:16   RT : 286145.8   LT : 286127.6
              No detector description was entered
              BAckground # 8 2/15/93

ROI #  8-1    RANGE :    1 =    3.78MeV  to    1 =    3.78MeV
              AREA : Gross = 0         Net area not defined.
```

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -1: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 20: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 30: | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| 40: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 60: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 90: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| 100: | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | |
| 110: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 120: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 140: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 150: | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 160: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 170: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 180: | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | |
| 190: | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 200: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 210: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | |
| 220: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 230: | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 240: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| 250: | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | |
| 260: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | |
| 270: | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | |
| 280: | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | |
| 290: | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 1 | |
| 300: | 3 | 0 | 1 | 5 | 1 | 1 | 0 | 1 | 0 | 1 | |
| 310: | 1 | 2 | 0 | 1 | 2 | 0 | 3 | 2 | 0 | 2 | |
| 320: | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | |
| 330: | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 3 | 1 | 3 | |
| 340: | 2 | 3 | 1 | 2 | 0 | 3 | 3 | 3 | 4 | 3 | |
| 350: | 6 | 10 | 12 | 12 | 13 | 5 | 5 | 5 | 0 | 0 | |
| 360: | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| 370: | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | |
| 380: | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 390: | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | |
| 400: | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| 410: | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 1 | 5 | |
| 420: | 1 | 5 | 4 | 1 | 5 | 2 | 5 | 3 | 3 | 5 | |
| 430: | 5 | 1 | 1 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | |
| 440: | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | |
| 450: | 0 | 0 | 0 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | |
| 460: | 3 | 5 | 3 | 6 | 8 | 14 | 9 | 5 | 9 | 3 | |
| 470: | 6 | 4 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 480: | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | |
| 490: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 500: | 12 | 14 | 8 | 16 | 14 | 9 | 10 | 16 | 16 | 16 | |
| 510: | 27 | | | | | | | | | | |

| | SAMPLE NAME | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| STEP | 41 | Th 42 | U 42 | | | | | | |
| Heat to near dryness | ✓ | ✓ | ✓ | | | | | | |
| Wash beaker— 2ml 0.001N Nitric, repeat 2X | ✓✓✓ | ✓ | ✓ | | | | | | |
| 1–2 Ml TTA, homogenize | ✓ | ✓ | ✓ | | | | | | |
| Centrifuge (2 min) | ✓ | ✓ | ✓ | | | | | | |
| Clean and label planchet, heat | ✓ | ✓ | ✓ | | | | | | |
| With new pipet, Separate, evaporate TTA on planchet | ✓ | ✓ | ✓ | | | | | | |
| Repeat extraction | ✓ | ✓ | ✓ | | | | | | |
| Burn off organic | ✓ | ✓ | ✓ | | | | | | |
| Place in labeled envelope | ✓ | ✓ | ✓ | | | | | | |

| | SAMPLE NAME | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| STEP | #41 | #42 | | | | | | |
| Column prep. | ✓ | ✓ 20ml | | | | | | |
| $Fe(OH)_3$ precip, pH→~7 | ✓ | ✓ | | | | | | |
| Wash and Centrifuge (2X) | ✓ | ✓ | | | | | | |
| pH→1,(.25 ml 1.0N $HNO_3$+2.0 ml 0.1N) $NH_4NO_3$ add.(5.9 g) | ✓ | ✓ | | | | | | |
| Sample to column, 70–80 ml to wash Fe off | ✓✓✓✓✓✓✓✓ | 5 ✓✓✓✓ | | | | | | |
| 100 ml 8N HCl, Th wash off | ✓✓✓✓✓ | ✓✓✓✓✓ | | | | | | |
| ≤5 ml wash 0.1N $HNO_3$ (discard) 50 ml 0.1N $HNO_3$— save U | 5ml 20 20 ✓ | 5ml ✓✓ | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -26: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 9 | 8 | | | | | | | | |
| -10: | 10 | 10 | 7 | 6 | 10 | 11 | 9 | 6 | 12 | 2 | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 20: | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 > 0.0001 cpm |
| 30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 40: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 50: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 60: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 90: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| 100: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 110: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 120: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 150: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 ⇒ 0.00048 cpm |
| 160: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 170: | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | |
| 180: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 190: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 200: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 220: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 230: | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | |
| 240: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | = 21 ⇒ 0.00504 cpm |
| 250: | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 260: | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 270: | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 280: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 290: | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| 300: | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 310: | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 | 1 | |
| 320: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 330: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ⇒ 4 ⇒ 0.00096 cpm |
| 340: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 350: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 360: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 370: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 410: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| 420: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 430: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 440: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 450: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 460: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 470: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 480: | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |

510: 24 3 0
k0G

Background #8

BWL
3/11/93

k0GMCB # 1 ACQ 03-02-93 AT 10:13:02 RT : 519751.5 LT : 519705.6
No detector description was entered
Background #8 3/8/93

Δt = 8662.53 min

ROI # 8-1 RANGE : 345 = 5.64MeV to 360 = 5.72MeV
AREA : Gross = 45 Net = 29 +/- 7
CENTROID : 352.90 = 5.68MeV
SHAPE : Fwhm = 0.01MeV Fwtm = 0.03MeV

ID : Th-227 at 5.69MeV
Corrected Rate = 0.000 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 10: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | | | | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 [ 1 ] [ | 0 |
| 0 | 0 | 1 | | | | | |
| 30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 40: | 0 | 0] | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 60: | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 70: | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 80: | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 90: | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 100: | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 110: | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 120: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 130: | 0 | 0 | 0 | 0 | 0 [ 15 ] [ | 0 | 0 |
| 0 | 1 | 0 | | | | | |
| 140: | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 150: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 160: | 3 | 0 | 0 | 0 | 0 | 1 | 1 |
| 4 | 0 | 0 | | | | | |
| 170: | 2 | 0 | 1 | 0] | 0 | 0 | 1 |
| 0 | 0 | 1 | | | | | |
| 180: | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | | | | | |
| 190: | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | | | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 220: | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 230: | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 240: | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 210: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 220: | 0 | | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 230: | 0 | | 0 | 0 | 2 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 240: | 0 | | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | | 0 | | | | | |
| 250: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 1 | | | | | |
| 260: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 1 | | | | | |
| 270: | 0 | [42] | [0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 2 | | 0 | | | | | |
| 280: | 1 | | 1 | 0 | 1 | 2 | 3 | 0 |
| 1 | 2 | | 0 | | | | | |
| 290: | 1 | | 0 | 2 | 0 | 1 | 1 | 2 |
| 1 | 2 | | 0 | | | | | |
| 300: | 1 | | 1 | 2 | 1 | 2 | 4 | 2 |
| 0 | 1 | | 0 | | | | | |
| 310: | 0 | | 0] | 3 | 1 | 0 | 0 | 0 |
| 0 | 3 | | 1 | | | | | |
| 320: | 0 | | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | | 0 | | | | | |
| 330: | 0 | | 0 | [55] [1 | 0 | 1 | 2 | 1 |
| 1 | 2 | | 0 | | | | | |
| 340: | 1 | | 0 | 1 | 0 | 0 | 1 | 2 |
| 1 | 3 | | 2 | | | | | |
| 350: | 6 | | 1 | 4 | 8 | 3 | 4 | 5 |
| 3 | 1 | | 1 | | | | | |
| 360: | 0 | | 0 | 0] | 0 | 0 | 0 | 1 |
| 0 | 0 | | 0 | | | | | |
| 370: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 2 | | | | | |
| 380: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 390: | 0 | | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 400: | 0 | | 1 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | | 0 | | | | | |
| 410: | 0 | | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | 0 | | 1 | | | | | |
| 420: | 1 | | 1 | 2 | 0 | 0 | 0 | 1 |
| 1 | 1 | | 1 | | | | | |
| 430: | 0 | | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | | 1 | | | | | |
| 440: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 450: | 0 | | 0 | 1 | 1 | 1 | 2 | 1 |
| 0 | 0 | | 1 | | | | | |
| 460: | 1 | | 3 | 1 | 2 | 3 | 3 | 5 |
| 5 | 6 | | 1 | | | | | |
| 470: | 3 | | 1 | 2 | 1 | 0 | 0 | 0 |
| 1 | 0 | | 0 | | | | | |
| 480: | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 1 | | | | | |
| 490: | 0 | | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | 0 | | | | | |
| 500: | 7 | | 3 | 8 | 9 | 4 | 7 | 12 |
| 5 | 2 | | 7 | | | | | |
| 510: | 8 | | 5 | | | | | |

k0G

MCS # 1 ACQ 09-10-93 AT 10:36:54 RT : 595553.4 LT : 595534.7
No detector description was entered
NOPI-ECP-28.3/13.0 Thorium spiked

ROI # 6-1 RANGE : 8 = 3.81MeV to 33 = 3.95MeV
AREA : Gross = 31 Net = 5 +/- 10
Could not properly fit the peak.

ROI # 6-2 RANGE : 70 = 4.17MeV to 170 = 4.74MeV
AREA : Gross = 28188 Net = 27988 +/- 177
CENTROID : 145.10 = 4.60MeV
SHAPE : Fwhm = 0.04MeV Fwtm = 0.14MeV

ID : U-235 at 4.60MeV
Corrected Rate = 0.047 +/- 0.00

ROI # 6-3 RANGE : 223 = 5.05MeV to 292 = 5.44MeV
AREA : Gross = 7850 Net = 6847 +/- 132
CENTROID : 274.88 = 5.34MeV
SHAPE : Fwhm = 0.04MeV Fwtm = 0.09MeV

ID : Th-228 at 5.34MeV
Corrected Rate = 0.011 +/- 0.00

ROI # 6-4 RANGE : 294 = 5.45MeV to 350 = 5.78MeV
AREA : Gross = 6153 Net = 5308 +/- 112
CENTROID : 321.83 = 5.61MeV
SHAPE : Fwhm = 0.04MeV Fwtm = 0.12MeV

ID : Th-227 at 5.67MeV
Corrected Rate = 0.009 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -36: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | | | | | | | |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 10: | 0 | 0 | 2 | 0 | 2 | 1 | 3 |
| 4 | 0 | 0 | | | | | |
| 20: | 2 | 0 | 2 | 0 | 0 | 2 | 2 |
| 1 | 0 | 2 | | | | | |
| 30: | 2 | 2 | 1 | 2 | 0 | 3 | 1 |
| 2 | 1 | 1 | | | | | |
| 40: | 2 | 4 | 0 | 2 | 1 | 4 | 0 |
| 1 | 2 | 2 | | | | | |
| 50: | 2 | 2 | 1 | 4 | 2 | 1 | 0 |
| 4 | 3 | 5 | | | | | |
| 60: | 7 | 0 | 1 | 2 | 3 | 1 | 1 |
| 6 | 2 | 2 | | | | | |
| 70: | 1 | 3 | 1 | 3 | 1 | 3 | 1 |
| 4 | 6 | 2 | | | | | |
| 80: | 8 | 2 | 5 | 3 | 3 | 1 | 3 |
| 1 | 4 | 1 | | | | | |
| 90: | 6 | 4 | 5 | 4 | 11 | 6 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 100: | 2 | 9 | 5 | 10 | 11 | 13 | 11 |
| 26 | 12 | 13 | | | | | |
| 110: | 7 | 13 | 15 | 17 | 17 | 8 | 11 |
| 10 | 16 | 14 | | | | | |
| 120: | 17 | 25 | 16 | 25 | 45 | 48 | 76 |
| 132 | 222 | 323 | | | | | |
| 130: | 507 | 636 | 745 | 862 | 910 | 871 | 725 |
| 606 | 514 | 602 | | | | | |
| 140: | 796 | 1209 | 1551 | 1925 | 2286 | 2510 | 2555 |
| 2313 | 1774 | 1122 | | | | | |
| 150: | 614 | 354 | 242 | 169 | 144 | 112 | 90 |
| 54 | 39 | 22 | | | | | |
| 160: | 10 | 9 | 7 | 2 | 3 | 3 | 4 |
| 6 | 2 | 2 | | | | | |
| 170: | 1 | 1 | 2 | 0 | 3 | 4 | 1 |
| 2 | 0 | 0 | | | | | |
| 180: | 1 | 4 | 3 | 2 | 1 | 1 | 4 |
| 0 | 2 | 2 | | | | | |
| 190: | 1 | 5 | 1 | 1 | 4 | 2 | 1 |
| 4 | 4 | 4 | | | | | |
| 200: | 2 | 1 | 1 | 0 | 3 | 4 | 2 |
| 4 | 1 | 2 | | | | | |
| 210: | 2 | 2 | 7 | 4 | 1 | 4 | 5 |
| 0 | 3 | 0 | | | | | |
| 220: | 3 | 1 | 1 | 0 | 2 | 5 | 0 |
| 2 | 3 | 3 | | | | | |
| 230: | 10 | 6 | 4 | 9 | 7 | 6 | 1 |
| 10 | 8 | 12 | | | | | |
| 240: | 8 | 6 | 7 | 5 | 3 | 11 | 9 |
| 9 | 5 | 8 | | | | | |
| 250: | 12 | 16 | 17 | 24 | 48 | 62 | 141 |
| 154 | 155 | 173 | | | | | |
| 260: | 201 | 212 | 234 | 197 | 159 | 80 | 73 |
| 85 | 119 | 183 | | | | | |
| 270: | 219 | 315 | 424 | 512 | 589 | 606 | 598 |
| 549 | 461 | 327 | | | | | |
| 280: | 159 | 107 | 72 | 64 | 73 | 54 | 45 |
| 39 | 23 | 31 | | | | | |
| 290: | 35 | 25 | 19 | 16 | 17 | 28 | 19 |
| 14 | 22 | 33 | | | | | |
| 300: | 29 | 32 | 36 | 39 | 54 | 46 | 53 |
| 49 | 60 | 60 | | | | | |
| 310: | 62 | 59 | 76 | 84 | 117 | 156 | 181 |
| 215 | 252 | 360 | | | | | |
| 320: | 428 | 525 | 519 | 490 | 445 | 306 | 217 |
| 165 | 128 | 89 | | | | | |
| 330: | 73 | 88 | 75 | 59 | 68 | 52 | 53 |
| 31 | 32 | 25 | | | | | |
| 340: | 19 | 17 | 14 | 16 | 10 | 14 | 6 |
| 11 | 10 | 10 | | | | | |
| 350: | 5 | 13 | 14 | 13 | 6 | 10 | 5 |
| 15 | 9 | 11 | | | | | |
| 360: | 6 | 13 | 5 | 8 | 14 | 17 | 13 |
| 21 | 23 | 32 | | | | | |
| 370: | 37 | 38 | 41 | 32 | 50 | 50 | 40 |
| 36 | 40 | 54 | | | | | |
| 380: | 50 | 70 | 104 | 116 | 141 | 129 | 114 |
| 120 | 107 | 87 | | | | | |
| 390: | 81 | 81 | 72 | 62 | 57 | 52 | 40 |
| 33 | 18 | 20 | | | | | |
| 400: | 13 | 12 | 15 | 13 | 13 | 12 | 13 |
| 26 | 11 | 14 | | | | | |
| 410: | 21 | 24 | 23 | 34 | 34 | 42 | 32 |
| 54 | 54 | 88 | | | | | |
| 420: | 96 | 133 | 176 | 233 | 270 | 333 | 362 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 430: | 330 | 223 | 142 | 71 | 40 | 30 | 27 |
| 28 | 40 | 20 | | | | | |
| 440: | 21 | 7 | 14 | 5 | 6 | 7 | 10 |
| 8 | 11 | 7 | | | | | |
| 450: | 15 | 8 | 9 | 6 | 14 | 4 | 11 |
| 11 | 15 | 4 | | | | | |
| 460: | 10 | 9 | 10 | 10 | 14 | 8 | 4 |
| 16 | 13 | 22 | | | | | |
| 470: | 15 | 11 | 19 | 20 | 21 | 23 | |

Background #1

BWL
3/11/93

kØGMCB # 1 ACQ Ø3-Ø4-93 AT Ø8:14:33 RT : 290663.4 LT : 290619.4
No detector description was entered
[redacted]

time: 4844.4 mins

ROI # 1-1 RANGE : 333 = 5.50MeV to 367 = 5.66MeV
AREA : Gross = 182 Net = 113 +/- 21
CENTROID : 359.43 = 5.63MeV
SHAPE : Fwhm = Ø.Ø2MeV Fwtm = Ø.Ø5MeV

ID : Th-227 at 5.67MeV
Corrected Rate = Ø.ØØØ +/- Ø.ØØ

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2: | Ø | Ø | Ø | Ø | Ø [23] | [Ø | [Ø |
| [1 = 238 U = 23 cts | | | | | | | |
| 1Ø: | Ø | Ø | Ø | Ø | 1 | 2 | 1 |
| 1 | Ø | Ø | | | | | |
| 2Ø: | Ø | Ø | 2 | Ø | Ø | Ø | Ø |
| Ø | 1 | Ø | | | | | |
| 3Ø: | Ø | 1 | Ø | 1 [ n ] | [1 | 1 | Ø |
| Ø | 2 | Ø | | | | | |
| 4Ø: | Ø | Ø | Ø | 1 | Ø | Ø | Ø |
| Ø | 1 | Ø | | | | | |
| 5Ø: | Ø | Ø | Ø | 1 | Ø | Ø | 1 |
| 1 | Ø | Ø | | | | | |
| 6Ø: | Ø | Ø | Ø | Ø | 1 | Ø | Ø |
| Ø | Ø | 1 | | | | | |
| 7Ø: | 1 | Ø]] | Ø] | Ø | Ø | Ø | 2 |
| Ø | Ø | 1 | | | | | |
| 8Ø: | Ø | 1 | Ø | 1 | Ø | Ø | Ø |
| Ø | 2 | Ø | | | | | |
| 9Ø: | Ø | 1 | Ø | 1 | 1 | Ø | 1 |
| 1 | 1 | Ø | | | | | |
| 1ØØ: | 1 | Ø | Ø | 1 | Ø | 1 | 1 |
| Ø | 1 | 1 | | | | | |
| 11Ø: | Ø | Ø | Ø | Ø | Ø | 1 | 1 |
| 1 | Ø | 1 | | | | | |
| 12Ø: [ 113 ] | [Ø | 3 | Ø | 2 | 2 | 1 234 U = 86 | [Ø |
| Ø | 1 | Ø | | | | | |
| 13Ø: | 2 | Ø | 2 | 1 | Ø | 3 | Ø |
| Ø | 1 | 1 | | | | | |
| 14Ø: | 4 | 1 | 1 | 1 | 2 | Ø [66 ] | [2 |
| Ø | 2 | 2 | | | | | |
| 15Ø: | Ø | 2 | Ø | 1 | Ø | 1 | 2 |
| 2 | 2 | 2 | | | | | |
| 16Ø: | 1 | 5 | 2 | 1 | Ø | 2 | 2 |
| 3 | 3 | 1 | | | | | |
| 17Ø: | 1 | Ø | 2 | 1 | 1 | 3 | Ø |
| 5 | 2 | 1 | | | | | |
| 18Ø: | 4 | 1 | 2 | 2 | 3]] | 3 | 4 |
| 4 | 2 | 3 | | | | | |
| 19Ø: | 2 | Ø] | Ø | 2 | Ø | Ø | Ø |
| 3 | Ø | Ø | | | | | |
| 2ØØ: | 1 | Ø | Ø | Ø | Ø | 1 | Ø |
| Ø | Ø | Ø | | | | | |
| 21Ø: | Ø | Ø | 1 | 1 | 2 | 1 | 2 |
| Ø | 1 | Ø | | | | | |
| 22Ø: | 1 | Ø | 1 | 2 | 1 | Ø | 1 |
| 2 | 1 | 3 | | | | | |
| 23Ø: | Ø | Ø | 1 | 1 | 1 | 1 | 1 |
| 1 | 3 | Ø | | | | | |
| 24Ø: | 2 | 1 | 1 | 232,1 [2 | [176] [Ø | Ø | Ø |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 230: | Ø | Ø | 1 | 1 | 1 | 1 | 1 |
| 1 | 3 | Ø | | | | | |
| 240: | 2 | 1 | 1 | $^{232}U$ [2 | [178] [Ø | Ø | Ø |
| Ø | 2 | 2 | | \|\| | | | |
| 250: | 1 | Ø | 3 | 103 cts 1 | 1 | 3 | Ø |
| 1 | Ø | 1 | | | | | |
| 260: | Ø | 2 | 3 | [148] [1 | 5 | Ø | 6 |
| 2 | 4 | 3 | | | | | |
| 270: | 4 | 3 | 3 | 5 | 7 | 2 | 5 |
| 5 | 3 | 1 | | | | | |
| 280: | 7 | 3 | 4 | 3 | 7 | 6 | 6 |
| 1Ø | 7 | 6 | | | | | |
| 290: | 7 | 5 | 7 | 4] | 7] | 4 | 6] |
| 4 | 5 | 4 | | | | | |
| 300: | 8 | 6 | 11 | 12 | 14 | 17 | 15 |
| 2Ø | 13 | 13 | | | | | |
| 310: | 7 | 1 | Ø | 3 | Ø | 1 | 1 |
| 3 | Ø | Ø | | | | | |
| 320: | Ø | Ø | 1 | Ø | Ø | Ø | 1 |
| Ø | 3 | 1 | | | | | |
| 330: | Ø | 3 | Ø | 4 | Ø | 2 | 1 |
| 2 | 2 | 2 | | | | | |
| 340: | 4 | 3 | 1 | 1 | 6 | 1 | 3 |
| 3 | 3 | 4 | | | | | |
| 350: | 9 | 6 | 4 | 3 | 4 | 12 | 12 |
| 8 | 15 | 14 | | | | | |
| 360: | 16 | 12 | 8 | 7 | 5 | 2 | 2 |
| 1 | Ø | Ø | | | | | |
| 370: | Ø | 1 | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 380: | Ø | Ø | Ø | Ø | 1 | 1 | Ø |
| 1 | 1 | Ø | | | | | |
| 390: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 400: | Ø | Ø | Ø | Ø | Ø | 1 | 1 |
| 1 | Ø | 2 | | | | | |
| 410: | Ø | 1 | 1 | 1 | Ø | Ø | Ø |
| Ø | 2 | 1 | | | | | |
| 420: | 2 | 1 | Ø | 1 | 2 | 4 | 1 |
| 2 | 1 | 5 | | | | | |
| 430: | 2 | 4 | 2 | 2 | 1 | 6 | 1 |
| 4 | 5 | 1 | | | | | |
| 440: | 2 | 1 | 2 | 4 | 2 | 1 | 1 |
| Ø | 3 | Ø | | | | | |
| 450: | 2 | Ø | Ø | Ø | 1 | 1 | 2 |
| 1 | 1 | Ø | | | | | |
| 460: | 1 | 2 | 1 | 2 | 3 | 3 | 2 |
| 5 | 2 | 4 | | | | | |
| 470: | 2 | 5 | 5 | 4 | 6 | 3 | 6 |
| 1Ø | 4 | 8 | | | | | |
| 480: | 18 | 11 | 13 | 8 | 14 | 6 | 4 |
| 2 | Ø | Ø | | | | | |
| 490: | Ø | Ø | Ø | Ø | 1 | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 500: | 25 | 26 | 27 | 29 | 27 | 21 | 25 |
| 31 | 23 | 23 | | | | | |
| 510: | 23 | 4 | Ø | Ø | | | |

Background #2

k0GMCB # 1  ACQ 03-08-93 AT 09:46:18  RT : 27100.7  LT : 27100.4

No detector description was entered

Background [redacted]

ROI # [redacted]1  RANGE : 199 = 4.82MeV to 208 = 4.87MeV

AREA : Gross = 12  Net = 2  +/- 3

Could not properly fit the peak.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -41: | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| 5 | 2 | 2 | 2 | | | | |
| -30: | 4 | 6 | 3 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 7 | | | | | |
| -10: | 8 | 4 | 11 | 5 | 4 | 5 | 7 |
| 4 | 9 | 3 | | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | | | | | |
| 10: | 5 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 2 | | | | | |
| 20: | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 40: | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 3 | 0 | | | | | |
| 50: | 0 | 2 | 2 | 2 | 0 | 3 | 0 |
| 0 | 0 | 0 | | | | | |
| 60: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 90: | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | | | | | |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 110: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 120: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 130: | 0 | 1 | 0 | 0 | 4 | 1 | 1 |
| 3 | 0 | 0 | | | | | |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 160: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 170: | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 180: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 190: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 200: | 1 | 1 | 4 | 2 | 0 | 0 | 0 |
| 2 | 2 | 0 | | | | | |
| 210: | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 220: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Ø | Ø | Ø | | | | |
| 2ØØ: | 1 | 1 | 4 | 2 | Ø | Ø | Ø |
| | 2 | 2 | Ø | | | | |
| 21Ø: | 1 | 1 | 1 | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 22Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 23Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 24Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 25Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 26Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 27Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 28Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 29Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 3ØØ: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 31Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 32Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 33Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 34Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 35Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 36Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 37Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 38Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 39Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 4ØØ: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 41Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 42Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 43Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 44Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 45Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 46Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| | Ø | Ø | Ø | | | | |
| 47Ø: | Ø | | | | | | |

k0G

time= 3104 minutes

MCB # 1 ACQ 02-08-93 AT 10:40:51 RT : 186245.3 LT : 186244.3
No detector description was entered
Background, channel 3, 11 Feb 1993

ROI # 3-1 RANGE : 414 = 5.64MeV to 414 = 5.64MeV
AREA : Gross = 0 Net area not defined.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6: | 0 | 0 [15] | [0 | 0 | | | | | | |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 20: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 30: | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| 40: | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 50: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70: | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0] |
| 90: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 110: | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 120: | 0 | 1 | 1 | 0 | 1 | 2 | 1 | 0 | 2 | 1 |
| 130: | 0 [39] | [1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 140: | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 150: | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 160: | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| 170: | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 |
| 180: | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 2 | 0 |
| 190: | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 2 | 0 |
| 200: | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1] |
| 210: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| 220: | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 230: | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 240: | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 250: | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| 260: | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2 |
| 270: | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 280: | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 1 | 0 |
| 290: | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 300: | 0 | 0 | 1 | 3 | 1 | 1 | 4 | 2 | 0 | 4 |
| 310: | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 4 | 2 |
| 320: | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 4 | 8 | 2 |
| 330: | 4 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 340: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 350: | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 360: | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 2 |
| 370: | 0 | 0 | 4 | 0 | 3 | 2 | 3 | 0 | 0 | 4 |
| 380: | 4 | 4 | 8 | 2 | 1 | 4 | 2 | 2 | 0 | 1 |
| 390: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 400: | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 410: | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 420: | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 430: | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 440: | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 450: | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 |
| 460: | 1 | 1 | 1 | 1 | 1 | 3 | 0 | 0 | 0 | 0 |
| 470: | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 480: | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 490: | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 2 |
| 500: | 5 | 10 | 5 | 14 | 6 | 9 | 10 | 12 | 14 | 9 |
| 510: | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |

Background #6

k0GMCB # 1 ACQ 03-08-93 AT 09:41:51 RT : 27101.8 LT : 27101.5

No detector description was entered

Background #6 3/8/93

time = 451.70 Min

ROI # 6-1 RANGE : 270 = 5.32MeV to 302 = 5.50MeV

AREA : Gross = 12 Net = -5 +/- 8

Could not properly fit the peak.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11: | 0 | 0 | 0 [0] | 0 | 0 [1] | 0 | 0 |
| 0 | 0 | | | | | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 40: | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 60: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 80: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 90: | 0 [1] | 0 | 0 | 0 | 0 | 0 | 0 |
| [1] 0 | 0 | 0 | | | | | |
| 100: | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 110: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 120: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 130: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 140: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 150: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 160: | 0 | 0 | 0 3 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 170: | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 180: | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | | | | | |
| 190: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 210: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 220: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 230: | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 240: | 0 | 0 | 0 | 0 | 0 [7] | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 250: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 260: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 270: | [illegible] 0 | 1 | 0 | 0 | 0 | 1 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 250: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 260: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 270: [12] | [Ø | 1 | Ø | Ø | Ø | 1 | Ø |
| 1 | Ø | Ø | | | | | |
| 280: | Ø | Ø | Ø | 2 | 1 | Ø | Ø |
| 1 | Ø | Ø | | | | | |
| 290: | Ø | Ø | Ø] | 1 | Ø [5 ] | [1 | Ø |
| Ø | 1 | Ø | | | | | |
| 300: | 1 | Ø | 1 | Ø] | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 310: | Ø | Ø | Ø [ \| ] | [Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 320: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø] | Ø | | | | | |
| 330: | Ø | Ø | Ø | 1 | Ø | Ø | Ø |
| Ø | Ø | Ø] | | | | | |
| 340: | Ø | Ø | Ø | Ø | Ø | 1 | Ø |
| Ø | Ø | 2 | | | | | |
| 350: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 360: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 370: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 380: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 390: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 400: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 410: | Ø | Ø | 1 | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 420: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 430: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 440: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| 1 | Ø | Ø | | | | | |
| 450: | Ø | Ø | Ø | 2 | 1 | Ø | Ø |
| Ø | 1 | Ø | | | | | |
| 460: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 470: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 480: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 490: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | 1 | Ø | | | | | |
| 500: | 1 | Ø | Ø | Ø | Ø | Ø | 1 |
| Ø | Ø | Ø | | | | | |
| 510: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 520: | Ø | Ø | Ø | | | | |

kØG

Background #7

BWL
3/11/92

kØGMCB # 1 ACQ Ø3-Ø2-93 AT 1Ø:13:15 RT : 341667.7 LT : 341626.2

No detector description was entered

Background #7 3/6/93

Δt = 5694.46 min

ROI # 7-1 RANGE : 285 = 5.27MeV to 317 = 5.44MeV

AREA : Gross = 67 Net = 34 +/- 14

Could not properly fit the peak.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -131: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | Ø | | | | |
| -12Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -11Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -1ØØ: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -9Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -8Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -7Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -6Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -5Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -4Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -3Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -2Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| -1Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 1Ø: | Ø | Ø | Ø | 1 | Ø | Ø | Ø |
| (Ø | Ø | Ø | | | | | |
| 238 2Ø: | Ø | Ø | Ø | Ø | Ø | 232 Th Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 3Ø: | Ø | Ø | [Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 4Ø: | Ø | 1 | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 5Ø: | Ø} | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 6Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | 1 | Ø | | | | | |
| 7Ø: | Ø | Ø | Ø | 1 | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 8Ø: | Ø | 1 | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 9Ø: | Ø | Ø | Ø | Ø | [Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 1ØØ: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 11Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | |
| 12Ø: | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | 1 | | | | | |
| 234 13Ø: | Ø | (Ø | Ø | Ø | Ø | Ø | Ø |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 110: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 120: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | 1 | | | | | | |
| 234 130: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 5 140: | Ø | Ø | Ø | 230 Th→5 Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 150: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 160: | Ø | Ø | Ø | Ø | Ø | 1 | 1 | |
| Ø | Ø | Ø | | | | | | |
| 170: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 180: | Ø} ] | Ø | 1 | 1 | Ø | 1 | Ø | |
| Ø | Ø | Ø | | | | | | |
| 190: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 200: | Ø | Ø | Ø | Ø | Ø | Ø) | Ø | |
| Ø | Ø | Ø | | | | | | |
| 210: | Ø | Ø | Ø | Ø | Ø | Ø | 1 | |
| Ø | Ø | Ø | | | | | | |
| 220: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | Ø | | | | | | |
| 230: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| (Ø | Ø | 1 | | | | | | |
| 232 240: | Ø | Ø | Ø | Ø | Ø | [Ø | Ø | |
| Ø | Ø | Ø | | | | | | |
| 250: | Ø | 1 | 1 | Ø | Ø | Ø | Ø | |
| Ø | Ø | 1 | | | | | | |
| 27 260: | Ø | Ø | Ø | Ø | 1 | Ø | Ø | |
| Ø | 1 | Ø | | | | | | |
| 270: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | Ø |
| Ø | Ø | 2 | | | | | | |
| 280: | Ø | Ø | Ø | Ø | 1 | Ø | Ø | |
| 2 | 1 | 1 | | | | | | |
| 290: | 1 | 1 | 1 | 1 | 2 | 1 | 2 | |
| 3 | 2 | Ø) | | | | | | |
| 300: | 3 | 1 | 2 | 1 | 1 | 2 | 2 | |
| Ø | 3 [75] | 4 | | | | | | |
| 310: | 6 | 5 | 12 | Ø | 3 | 2 | 2 | |
| Ø | Ø | Ø | | | | | | |
| 320: | Ø] | Ø | Ø | Ø | Ø | Ø | Ø | |
| Ø | Ø | Ø | | | | | | |
| 330: | Ø | [Ø [36] | Ø | Ø | Ø | Ø | Ø | |
| Ø | 1 | Ø | | | | | | |
| 340: | Ø | Ø | Ø | Ø | 1 | 2 | Ø | |
| Ø | 1 | Ø | | | | | | |
| 350: | Ø | Ø | 224 Ra ⇒ (1 | 2 | 1 | Ø | 1 | |
| 2 | 1 | 2 | 31 | | | | | |
| 360: | 4 | 8 | 3 | 2 | 4 | Ø | Ø | |
| Ø | Ø) | Ø] | | | | | | |
| 370: | Ø | Ø | Ø | Ø | Ø | Ø | Ø | |
| Ø | Ø | Ø | | | | | | |
| 380: | Ø | | | | | | | |

kØG

## MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES

sample # **92-3/BH-12 #42** Sep. date **2/13/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 617.28 | 0.4286 | 22.58 | 12/27/92 | 37 | *22.55699* |

Th228/U232 *0.359*

Counting time for Th = 21222.5 (min.)
Days btwn. sep. & count. = 2 (days)
*CF for Th-228* = *.9908*

Counting time for U = 21216.79 (min.)
Days btwn. sep. & count. = 2 (days)
*CF for U-232* = *1.0090*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 13 | 67 | 726 | 300 |
| bkgd | bkgd | bkgd | bkgd |
| 0.0001 | 0.00048 | 0.00504 | 0.00096 |

bkgd time 1 (min.)

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 399 | 942 | 4496 |
| bkgd | bkgd | bkgd |
| 0.00024 | 0.0001 | 0.00312 |

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *10.87775* | *56.8132* | *598.97977* | *279.626* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *393.908* | *939.878* | *4390.4* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **1.41E-03** | ± | **7.34E-05** |
| U-234(dpm/g) = | **3.35E-03** | ± | **1.20E-04** |
| Th-232(dpm/g) = | **1.02E-04** | ± | **2.86E-05** |
| Th-230(dpm/g) = | **5.33E-04** | ± | **6.81E-05** |
| U-234/U-238 = | **2.3860** | ± | **0.1425** |
| Th-230/U-234 = | **0.1591** | ± | **0.0201** |
| Th-230/Th-232 = | **5.2229** | ± | **1.5829** |
| U-234/Th-232 = | **32.8360** | ± | **9.2633** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

| | | | |
|---|---|---|---|
| **U (ppb) =** | **1.883** | ± | **0.308** |
| **Th (ppb) =** | **0.418** | ± | **0.117** |

#41&#42 234/238 avg rat

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | Calculation of weighted average (up to 200 data sets can be input) | | | | | | |
| 2 | | | weighted average= | 2.45349 | | average= | 2.54615 |
| 3 | | | weighted error= | 0.1266 | 0.310438 | std.= | 0.2264863 |
| 4 | | | | | | | |
| 5 | data ± err | | | error^2 | 1/error^2 | data/error^2 | |
| 6 | 2.386 | ± | 0.1425 | 0.020306 | 49.24592 | 117.50077 | |
| 7 | 2.7063 | ± | 0.2758 | 0.076066 | 13.14654 | 35.578482 | |
| 8 | | ± | | 0 | 0 | 0 | |
| 9 | | ± | | 0 | 0 | 0 | |
| 10 | | ± | | 0 | 0 | 0 | |
| 11 | | ± | | 0 | 0 | 0 | |
| 12 | | ± | | 0 | 0 | 0 | |
| 13 | | ± | | 0 | 0 | 0 | |
| 14 | | ± | | 0 | 0 | 0 | |
| 15 | | ± | | 0 | 0 | 0 | |
| 16 | | ± | | 0 | 0 | 0 | |
| 17 | | ± | | 0 | 0 | 0 | |
| 18 | | ± | | 0 | 0 | 0 | |
| 19 | | ± | | 0 | 0 | 0 | |
| 20 | | ± | | 0 | 0 | 0 | |
| 21 | | ± | | 0 | 0 | 0 | |
| 22 | | ± | | 0 | 0 | 0 | |
| 23 | | ± | | 0 | 0 | 0 | |
| 24 | | ± | | 0 | 0 | 0 | |
| 25 | | ± | | 0 | 0 | 0 | |
| 26 | | ± | | 0 | 0 | 0 | |
| 27 | | ± | | 0 | 0 | 0 | |
| 28 | | ± | | 0 | 0 | 0 | |
| 29 | | ± | | 0 | 0 | 0 | |
| 30 | | ± | | 0 | 0 | 0 | |
| 31 | | ± | | 0 | 0 | 0 | |
| 32 | | ± | | 0 | 0 | 0 | |
| 33 | | ± | | 0 | 0 | 0 | |
| 34 | | ± | | 0 | 0 | 0 | |
| 35 | | ± | | 0 | 0 | 0 | |
| 36 | | ± | | 0 | 0 | 0 | |
| 37 | | ± | | 0 | 0 | 0 | |
| 38 | | ± | | 0 | 0 | 0 | |
| 39 | | ± | | 0 | 0 | 0 | |
| 40 | | ± | | 0 | 0 | 0 | |
| 41 | | ± | | 0 | 0 | 0 | |
| 42 | | ± | | 0 | 0 | 0 | |
| 43 | | ± | | 0 | 0 | 0 | |
| 44 | | ± | | 0 | 0 | 0 | |
| 45 | | ± | | 0 | 0 | 0 | |

1.71 ppb ± .14

Bret Leslie 3/12/93

Bret Leslie
3/11/93

kOGMCB # 1 ACQ 02-15-93 AT 16:24:44 RT : 1273007.5 LT : 1272961.6
No detector description was entered
92-3/BH-12*42 Uranium Nopal I

time= 21216.79min

ROI # 7-1 RANGE : 62 = 4.08MeV to 90 = 4.23MeV
AREA : Gross = 399 Net = 372 +/- 22
CENTROID : 81.43 = 4.18MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.09MeV

ID : U-238 at 4.20MeV
Corrected Rate = 0.000 +/- 0.00

ROI # 7-2 RANGE : 157 = 4.58MeV to 194 = 4.78MeV
AREA : Gross = 942 Net = 410 +/- 57
CENTROID : 189.02 = 4.76MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.04MeV

ID : U-234 at 4.78MeV
Corrected Rate = 0.000 +/- 0.00

ROI # 7-3 RANGE : 196 = 4.79MeV to 205 = 4.84MeV
AREA : Gross = 78 Net = 10 +/- 7
Could not properly fit the peak.

ROI # 7-4 RANGE : 253 = 5.10MeV to 301 = 5.36MeV
AREA : Gross = 4496 Net = 4349 +/- 74
CENTROID : 290.97 = 5.30MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.10MeV

ID : U-232 at 5.32MeV
Corrected Rate = 0.003 +/- 0.00

kOGkOG -19: 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 10: | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | | | | | |
| 20: | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| 1 | 1 | 0 | | | | | |
| 30: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 40: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 50: | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 60: | 2 | 0 | 0 | 1 | 1 | 1 | 4 |
| 2 | 1 | 5 | | | | | |
| 70: | 7 | 14 | 14 | 17 | 11 | 13 | 9 |
| 10 | 15 | 30 | | | | | |
| 80: | 37 | 57 | 58 | 48 | 24 | 11 | 5 |
| 2 | 1 | 1 | | | | | |
| 90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | | | | | |
| 100: | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 2 | | | | | |
| 110: | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 120: | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | | | | | |
| 130: | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | | | | | |
| 140: | 1 | 4 | 2 | 2 | 1 | 0 | 1 |
| 2 | 1 | 3 | | | | | |
| 150: | 0 | 2 | 1 | 1 | 1 | 2 | 0 |
| 3 | 1 | 3 | | | | | |
| 160: | 0 | 2 | 2 | 0 | 1 | 2 | 1 |
| 2 | 2 | 4 | | | | | |
| 170: | 7 | 4 | 4 | 1 | 11 | 8 | 17 |
| 15 | 18 | 30 | | | | | |
| 180: | 30 | 38 | 34 | 20 | 32 | 36 | 48 |
| 77 | 87 | 141 | | | | | |
| 190: | 111 | 73 | 40 | 27 | 10 | 13 | 10 |
| 13 | 16 | 15 | | | | | |
| 200: | 12 | 9 | 1 | 1 | 1 | 0 | 3 |
| 1 | 1 | 1 | | | | | |
| 210: | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| 0 | 0 | 1 | | | | | |
| 220: | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | | | | | |
| 230: | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 2 | 1 | | | | | |
| 240: | 0 | 2 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | | | | | |
| 250: | 0 | 0 | 1 | 0 | 2 | 2 | 2 |
| 1 | 1 | 4 | | | | | |
| 260: | 2 | 2 | 3 | 2 | 1 | 1 | 5 |
| 3 | 1 | 4 | | | | | |
| 270: | 3 | 6 | 11 | 14 | 15 | 17 | 30 |
| 68 | 109 | 150 | | | | | |
| 280: | 170 | 195 | 161 | 162 | 115 | 114 | 141 |
| 169 | 227 | 378 | | | | | |
| 290: | 473 | 491 | 504 | 345 | 225 | 96 | 34 |
| 17 | 6 | 6 | | | | | |
| 300: | 6 | 2 | 2 | 6 | 8 | 11 | 8 |
| 8 | 24 | 12 | | | | | |
| 310: | 28 | 31 | 28 | 24 | 13 | 8 | 4 |
| 4 | 2 | 0 | | | | | |
| 320: | 2 | 3 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 330: | 1 | 1 | 0 | 1 | 1 | 0 | 2 |
| 0 | 0 | 0 | | | | | |
| 340: | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 2 | 1 | 0 | | | | | |
| 350: | 3 | 1 | 1 | 2 | 3 | 2 | 7 |
| 8 | 10 | 21 | | | | | |
| 360: | 15 | 17 | 13 | 19 | 10 | 8 | 6 |
| 0 | 1 | 0 | | | | | |
| 370: | 2 | 0 | 0 | 2 | 0 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 380: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 410: | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | | | | | |
| 420: | 1 | 0 | 1 | 1 | 2 | 1 | 4 |
| 2 | 3 | 0 | | | | | |
| 430: | 3 | 1 | 3 | 3 | 3 | 3 | 1 |
| 4 | 3 | 2 | | | | | |
| 440: | 1 | 3 | 2 | 2 | 2 | 1 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 450: | 0 | 1 | 0 | 0 | 0 | 2 | 3 |
| 3 | 1 | 0 | | | | | |
| 460: | 2 | 0 | 0 | 1 | 3 | 2 | 2 |
| 1 | 4 | 9 | | | | | |
| 470: | 12 | 9 | 17 | 9 | 17 | 20 | 17 |
| 14 | 10 | 10 | | | | | |
| 480: | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 490: | 0 | 0 | 0 | | | | |

k06

Bret Leslie
3/11/93

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| k0G -2: | 21 | 3 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | | | |
| 10: | 1 | 2 | 1 | 2 | 1 | 0 | 0 |
| 0 | 1 | 1 | | | | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | | | | | |
| 30: | 2 | 1 | 1 | 2 | 0 | 1 | 2 |
| 0 | 1 | 1 | | | | | |
| 40: | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | | | | | |
| 50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 60: | 2 | 1 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 2 | | | | | |
| 70: | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 2 | 0 | | | | | |
| 80: | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 90: | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 2 | 1 | | | | | |
| 100: | 0 | 1 | 2 | 0 | 0 | 0 | 2 |
| 0 | 0 | 1 | | | | | |
| 110: | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| 0 | 1 | 0 | | | | | |
| 120: | 0 | 0 | 1 | 0 | 1 | 2 | 2 |
| 2 | 0 | 0 | | | | | |
| 130: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 2 | | | | | |
| 140: | 0 | 1 | 0 | 0 | 4 | 0 | 3 |
| 3 | 0 | 1 | | | | | |
| 150: | 8 | 1 | 2 | 3 | 4 | 3 | 3 |
| 8 | 1 | 4 | | | | | |
| 160: | 2 | 2 | 2 | 3 | 7 | 4 | 3 |
| 2 | 3 | 1 | | | | | |
| 170: | 2 | 4 | 2 | 1 | 3 | 3 | 5 |
| 7 | 4 | 4 | | | | | |
| 180: | 5 | 9 | 5 | 11 | 8 | 8 | 16 |
| 20 | 31 | 28 | | | | | |
| 190: | 26 | 16 | 9 | 3 | 3 | 1 | 1 |
| 1 | 0 | 0 | | | | | |
| 200: | 0 | 0 | 1 | 2 | 0 | 2 | 0 |
| 1 | 0 | 1 | | | | | |
| 210: | 0 | 0 | 0 | 2 | 0 | 2 | 1 |
| 1 | 2 | 0 | | | | | |
| 220: | 0 | 1 | 2 | 0 | 0 | 0 | 2 |
| 0 | 1 | 1 | | | | | |
| 230: | 0 | 1 | 2 | 0 | 0 | 3 | 0 |
| 0 | 0 | 1 | | | | | |
| 240: | 1 | 0 | 1 | 1 | 2 | 0 | 3 |
| 1 | 2 | 1 | | | | | |
| 250: | 1 | 3 | 2 | 4 | 2 | 1 | 2 |
| 0 | 1 | 5 | | | | | |
| 260: | 3 | 2 | 1 | 4 | 4 | 0 | 5 |
| 3 | 5 | 2 | | | | | |
| 270: | 5 | 1 | 1 | 3 | 3 | 2 | 2 |
| 4 | 2 | 9 | | | | | |
| 280: | 9 | 6 | 14 | 12 | 11 | 12 | 29 |
| 21 | 20 | 16 | | | | | |
| 290: | 9 | 10 | 12 | 8 | 11 | 9 | 13 |
| 11 | 28 | 33 | | | | | |
| 300: | 33 | 57 | 58 | 71 | 62 | 45 | 26 |
| 16 | 7 | 7 | | | | | |
| 310: | 18 | 4 | 4 | 3 | 4 | 8 | 14 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3 | 6 | 6 | | | | |
| 320: | | 1 | 5 | 3 | 5 | 1 | 1 | 4 |
| | 3 | 3 | 4 | | | | |
| 330: | | 1 | 7 | 4 | 5 | 2 | 5 | 5 |
| | 9 | 3 | 10 | | | | |
| 340: | | 9 | 9 | 5 | 6 | 16 | 12 | 16 |
| | 15 | 30 | 23 | | | | |
| 350: | | 35 | 41 | 55 | 47 | 44 | 32 | 19 |
| | 6 | 7 | 2 | | | | |
| 360: | | 0 | 2 | 1 | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | | | | |
| 370: | | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| | 2 | 0 | 0 | | | | |
| 380: | | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 0 | 1 | 1 | | | | |
| 390: | | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 1 | 0 | 0 | | | | |
| 400: | | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| | 0 | 1 | 2 | | | | |
| 410: | | 0 | 1 | 2 | 4 | 2 | 1 | 1 |
| | 6 | 3 | 6 | | | | |
| 420: | | 5 | 13 | 14 | 6 | 12 | 10 | 6 |
| | 5 | 6 | 9 | | | | |
| 430: | | 7 | 2 | 7 | 3 | 3 | 1 | 2 |
| | 3 | 4 | 1 | | | | |
| 440: | | 1 | 2 | 1 | 1 | 0 | 0 | 2 |
| | 1 | 2 | 5 | | | | |
| 450: | | 1 | 5 | 6 | 1 | 2 | 8 | 5 |
| | 9 | 8 | 13 | | | | |
| 460: | | 16 | 21 | 27 | 25 | 32 | 36 | 49 |
| | 41 | 45 | 35 | | | | |
| 470: | | 18 | 13 | 6 | 3 | 0 | 0 | 0 |
| | 1 | 0 | 0 | | | | |
| 480: | | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | |
| 490: | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | | | | |
| 500: | | 64 | 67 | 61 | 61 | 67 | 81 | 61 |
| | 47 | 72 | 63 | | | | |

k0Gk0GMCB # 1 ACQ 02-15-93 AT 16:24:44 RT : 1273350.7 LT : 1273304.8

No detector description was entered

92-3/BH-12*42 Thorium Nopal I

time = 21222.5 minutes

ROI # 8-1 RANGE : 28 = 3.92MeV to 39 = 3.98MeV

AREA : Gross = 13 Net = 1 +/- 4

Could not properly fit the peak.

ROI # 8-2 RANGE : 149 = 4.58MeV to 169 = 4.69MeV

AREA : Gross = 67 Net = 11 +/- 12

Could not properly fit the peak.

ROI # 8-3 RANGE : 173 = 4.71MeV to 196 = 4.83MeV

AREA : Gross = 227 Net = 179 +/- 18

CENTROID : 188.60 = 4.79MeV

SHAPE : Fwhm = 0.03MeV Fwtm = 0.07MeV

ID : Th-229 at 4.80MeV

Corrected Rate = 0.000 +/- 0.00

ROI # 8-4 RANGE : 271 = 5.24MeV to 313 = 5.46MeV

AREA : Gross = 726 Net = 597 +/- 37

CENTROID : 302.78 = 5.41MeV

SHAPE : Fwhm = 0.02MeV Fwtm = 0.07MeV

ID : Th-228 at 5.42MeV
Corrected Rate = 0.000 +/- 0.00

k0G

2/28/92 Sample preparation for Peña Blanca Trip

Because we do not know a priori what the sample location will be I will just generically assign numbers to the sample bottles & put their sample name (based on location) after sampling

| Sample Bottle # | Sample Name | Weight Bottle EMPTY (g) | Weight Bottle + Sample + Acid | Acid Added (ml) | Sample Weight (g) | |
|---|---|---|---|---|---|---|
| 37 | | 101.22 | | | | |
| 38 | | 101.30 | | | | |
| 39 | | 101.09 | 1137.0 No Acid | | 1035.91 | 3/17/92 BWL |
| 40 | | 102.15 | | | | |
| 41 | | 101.08 | 1120.3 | 10 ml | 1009.22 | BWL 3/17/92 |
| 42 | | 100.77 | 1074.8 | 10 ml | 964.03 | BWL 3/17/92 |
| 43 | | 55.08 | | | | |
| 44 | | 55.44 | | | | |
| 45 | | 54.82 | | | | |
| 46 | | 55.45 | | | | |
| 47 | | 55.30 | | | | |

BWL

O.C.L. THE FOLLOWING WATER SAMPLES (SIX) HAVE BEEN STORED IN THE REFRIGERATOR. THEY WERE TAKEN OUT AND ALLOWED TO REACH ROOM TEMPERATURE. THE SAMPLES WERE WEIGHED ON A TOP LOADING BALANCE.

2/12/93
SWL

| | SAMPLE I.D. | WEIGHT BOTTLE + SAMPLE | Dry EMPTY Bottle |
|---|---|---|---|
| ① | EM-1-1 | 225.61 g | 55.89 |
| ② | EM-1-2 | 978.40 g | 104.73 |
| ③ | BH-12-1 | 160.43 g | 56.96 |
| ④ | BH-12-2 | 576.67 g | 105.64 |
| ⑤ | 92-31 BH-12 * 41 | 817.50 g | 104.84 |
| ⑥ | 92-31 BH-12 * 42 | 720.40 g | 103.12 |

4:00PM AFTER WEIGHING, EACH SAMPLE IS SPIKED WITH URANIUM SAMPLE # 17A-1A. APPROXIMATELY 0.40 g OF SPIKE IS WEIGHED ON A WEIGHING BOAT AND TRANSFERRED INTO THE SAMPLE SOLUTION. THE WEIGHING BOAT IS THEN RINSED WITH 0.1 $HNO_3$ TO ENSURE THAT ALL THE SPIKE IS TRANSFERRED. Next, APPROXIMATELY 20 mg OF Fe carrier ARE ADDED TO EACH SAMPLE USING A CLEAN PASTUER PIPET. THE SOLUTIONS ARE THEN ALLOWED TO EQUILIBRATE FOR 24 HOURS. THE FOLLOWING DATA SHOWS THE MASS OF SPIKE USED IN EACH SAMPLE AND THE TOTAL MASS USED.

| | SPIKE USED |
|---|---|
| EM-1-1 | .4209 g |
| EM-1-2 | .4212 g |

| | |
|---|---|
| BH-12-1 | .4283 g |
| BH-12-2 | .4318 g |
| 92-3/BH-12 #41 | .4246 g |
| 92-3/BH-12 #42 | .4286 g |
| TOTAL USED : | 2.5554 g |

## MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES

sample # **NOPI-ECP-28.3/13.0-Unspiked** Sep. date **3/5/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 0.0043565 | 6.2016 | 22.59 | 12/27/92 | 68 | *22.54771* |

Th228/U232 *0.38*

Counting time for Th = 2724.34 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for Th-228 =* *.9941*

Counting time for U = 1796.05 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for U-232 =* *1.0054*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 10 | 7663 | 1124 | 898 |

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 496 | 517 | 365 |

| bkgd | bkgd | bkgd | bkgd |
|---|---|---|---|
| 0.0001756 | 0.002214 | 0.015497 | 0.01107 |

| bkgd | bkgd | bkgd |
|---|---|---|
| 0.002477 | 0.013624 | 0.03055 |

bkgd time 1 (min.)

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228sp counts | Ra-224* counts |
|---|---|---|---|
| *9.521606* | *7656.96831* | *1032.3941* | *867.842* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *491.55118* | *492.531* | *308.46* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **5.11E+04** | ± | **3.53E+03** |
| U-234(dpm/g) = | **5.13E+04** | ± | **3.50E+03** |
| Th-232(dpm/g) = | **1.12E+02** | ± | **3.57E+01** |
| Th-230(dpm/g) = | **9.05E+04** | ± | **2.89E+03** |
| U-234/U-238 = | **1.0020** | ± | **0.0630** |
| Th-230/U-234 = | **1.7651** | ± | **0.0802** |
| Th-230/Th-232 = | **804.1677** | ± | **254.4660** |
| U-234/Th-232 = | **455.5999** | ± | **148.0269** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

**U (ppm) =** **68530.282**

**Th (ppm) =** **460.165**

Bret Leslie 3/12/93

Bret Leslie
3/12/93

MCB # 1 ACQ 03-10-93 AT 10:37:01 RT : 163119.6 LT : 163110.3
No detector description was entered
NOPI-ECP-28.3/13.0 U spiked partial count

time= 2718.66

ROI # 1-1 RANGE : 48 = 4.06MeV to 73 = 4.21MeV
AREA : Gross = 490 Net = 439 +/- 26
CENTROID : 64.23 = 4.17MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.09MeV

ID : U-238 at 4.15MeV
Corrected Rate = 0.003 +/- 0.00

ROI # 1-2 RANGE : 153 = 4.61MeV to 187 = 4.77MeV
AREA : Gross = 511 Net = 475 +/- 25
CENTROID : 177.31 = 4.73MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.11MeV

ID : U-~~238~~ 234 at 4.73MeV
Corrected Rate = 0.003 +/- 0.00

ROI # 1-3 RANGE : 263 = 5.15MeV to 294 = 5.30MeV
AREA : Gross = 365 Net = 280 +/- 25
CENTROID : 286.35 = 5.27MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.05MeV

ID : U-232 at 5.26MeV
Corrected Rate = 0.002 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | | | | | | |
| 10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 20: | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 30: | 0 | 1 | 0 | 0 | [1 | 0 | 0 |
| 1 | 1 | 1 | | | | | |
| 40: | 1 | 1 | 0 | U238 11 496 | 3 | 0 | 5 | 6 |
| 0 | 6 | 4 | | | | | |
| 50: | 6 | 6 | 11 | 16 | 21 | 12 | 22 |
| 26 | 21 | 24 | | | | | |
| 60: | 22 | 21 | 33 | 40 | 41 | 50 | 31 |
| 39 | 12 | 7 | | | | | |
| 70: | 3 | 2] | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 80: | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| 1 | 2 | 3 | | | | | |
| 90: | 0 | 1 | 1 | 2 | 1 | 2 | 1 |
| 0 | 1 | 4 | | | | | |
| 100: | 3 | 4 | 1 | 5 | 2 | 2 | 0 |
| 1 | 0 | 1 | | | | | |
| 110: | 1 | 0 | 1 | 0 | 2 | 1 | 0 |
| 0 | 1 | 1 | | | | | |
| 120: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | | | | | |
| 130: | 0 | 2 | 1 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | | | | | |
| 140: | 1 | 0 | 1 | 0 | 4 | 4 | 234 U 11 [0 |
| 2 | 1 | 2 | | | | | |
| 150: | 2 | 2 | 0 | 0 | 2 | 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 160: | 4 | 10 | 7 | 7 | 24 | 17 | 51+ | 18 |
| 20 | 21 | 19 | | | | | | |
| 170: | 16 | 14 | 9 | 20 | 22 | 31 | | 32 |
| 40 | 52 | 48 | | | | | | |
| 180: | 36 | 11 | 7 | 4 | 1] | 0 | | 1 |
| 21 | 0 | 0 | | | | | | |
| 190: | 2 | 1 | 3 | 1 | 0 | 0 | | 0 |
| 1 | 0 | 0 | | | | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 1 | | | | | | |
| 210: | 0 | 0 | 1 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 220: | 0 | 0 | 0 | 1 | 1 | 0 | | 0 |
| 0 | 1 | 0 | | | | | | |
| 230: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 3 | | | | | | |
| 240: | 0 | 0 | 0 | 1 | 0 | 1 | | 1 |
| 0 | 0 | 1 | | | | | | |
| 250: | 1 | 1 | 1 | 1 | 2 | 0 | | 0 |
| 0 | 4 | 1 | | | | | | |
| 260: | 3 | 1 | 1 | 232U = 365 [1 | 2 | 3 | | 1 |
| 3 | 5 | 7 | | | | | | |
| 270: | 13 | 5 | 12 | 14 | 17 | 16 | | 13 |
| 14 | 6 | 8 | | | | | | |
| 280: | 3 | 13 | 15 | 14 | 16 | 31 | | 39 |
| 34 | 22 | 15 | | | | | | |
| 290: | 8 | 5 | 4 | 4 | 2] | 2 | | 5 |
| 2 | 2 | 5 | | | | | | |
| 300: | 6 | 6 | 6 | 5 | 13 | 5 | | 7 |
| 15 | 7 | 7 | | | | | | |
| 310: | 2 | 5 | 3 | 0 | 0 | 1 | | 2 |
| 0 | 0 | 0 | | | | | | |
| 320: | 1 | 0 | 0 | 0 | 0 | 0 | | 1 |
| 2 | 0 | 0 | | | | | | |
| 330: | 1 | 0 | 0 | 0 | 0 | 3 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 340: | 1 | 2 | 3 | 1 | 1 | 1 | | 0 |
| 1 | 1 | 1 | | | | | | |
| 350: | 3 | 3 | 4 | 2 | 1 | 2 | | 7 |
| 1 | 11 | 8 | | | | | | |
| 360: | 11 | 11 | 7 | 7 | 2 | 0 | | 1 |
| 1 | 0 | 0 | | | | | | |
| 370: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 380: | 0 | 0 | 0 | 1 | 0 | 0 | | 0 |
| 1 | 0 | 0 | | | | | | |
| 390: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 400: | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 0 | 1 | | | | | | |
| 410: | 0 | 0 | 0 | 2 | 0 | 1 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 420: | 1 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 0 | 2 | 1 | | | | | | |
| 430: | 2 | 1 | 0 | 0 | 0 | 1 | | 0 |
| 1 | 2 | 1 | | | | | | |
| 440: | 0 | 2 | 4 | 0 | 0 | 3 | | 0 |
| 0 | 0 | 0 | | | | | | |
| 450: | 0 | 1 | 0 | 0 | 0 | 1 | | 0 |
| 2 | 1 | 0 | | | | | | |
| 460: | 0 | 1 | 1 | 1 | 0 | 1 | | 0 |
| 0 | 1 | 1 | | | | | | |
| 470: | 1 | 1 | 4 | 3 | 2 | 3 | | 1 |
| 6 | 8 | 7 | | | | | | |
| 480: | 8 | 7 | 9 | 10 | 4 | 4 | | 4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 490: | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 500: | 8 | 10 | 12 | 12 | 12 | 11 | 18 |
| 14 | 5 | 9 | | | | | |
| 510: | 11 | 3 | 0 | | | | |

Bret Leslie
3/12/93

time = 2724.34 minutes

MCB # 1 ACQ 03-10-93 AT 10:36:54 RT : 163460.6 LT : 163451.3
No detector description was entered
NOPI-ECP-28.3/13.0 Thorium spiked partial

ROI # 6-1 RANGE : 13 = 3.84MeV to 37 = 3.98MeV
AREA : Gross = 10 Net = -13 +/- 8
Could not properly fit the peak.

ROI # 6-2 RANGE : 97 = 4.32MeV to 151 = 4.63MeV
AREA : Gross = 7278 Net = 5635 +/- 138
CENTROID : 142.33 = 4.58MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.06MeV

ID : U-235 at 4.60MeV
Corrected Rate = 0.034 +/- 0.00

ROI # 6-3 RANGE : 244 = 5.17MeV to 278 = 5.36MeV
AREA : Gross = 1860 Net = 1458 +/- 58
CENTROID : 271.58 = 5.32MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.05MeV

ID : U-232 at 5.32MeV
Corrected Rate = 0.009 +/- 0.00

ROI # 6-4 RANGE : 295 = 5.46MeV to 344 = 5.74MeV
AREA : Gross = 921 Net = 778 +/- 43
CENTROID : 317.56 = 5.59MeV
SHAPE : Fwhm = 0.04MeV Fwtm = 0.13MeV

ID : Th-227 at 5.67MeV
Corrected Rate = 0.005 +/- 0.00

ROI # 6-5 RANGE : 407 = 6.10MeV to 437 = 6.27MeV
AREA : Gross = 509 Net = 405 +/- 29
CENTROID : 423.05 = 6.19MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.07MeV

ID : No close library match

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -19: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 10: | 0 | 0 | 0 | 0 | 232Th = 10 [1 | 1 | 0 |
| 1 | 0 | 0 | | | | | |
| 20: | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1 | 0 | 0 | | | | | |
| 30: | 0 | 2 | 0 | 0 | 0 | 2] | 0 |
| 0 | 0 | 0 | | | | | |
| 40: | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| 0 | 2 | 2 | | | | | |
| 50: | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 1 | 0 | | | | | |
| 60: | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 70: | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 2 | 2 | 1 | | | | | |
| 80: | 2 | 0 | 3 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | | | | | |
| 90: | 1 | 2 | 0 | 2 | 0 | 3 | 0 |
| [2 | 1 | 2 | | | | | |
| 100: | 1 | 3 | 3 | 2 | 5 | 5 | 5 |
| 8 | 4 | 4 | | | | | |
| 110: | 4 | 6 | 5 | 4 | 10 | 2 | 2 |
| 3 | 4 | 6 | | | | | |
| 120: | 6 | 12 | 5 | 10 | 24 | 26 | 50 |
| 83 | 149 | 220 | | | | | |
| 130: | 280 | 308 | 248 | 197 | 107 | 76 | 80 |
| 128 | 196 | 332 | | | | | |
| 140: | 499 | 754 | 872 | 837 | 680 | 457 | 209 |
| 106 | 62 | 40 | | | | | |
| 150: | 63 | 71 | 73 | 69 | 68 | 55 | 57 |
| 38 | 32 | 18 | | | | | |
| 160: | 4 | 5 | 4 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | | | | | |
| 170: | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 180: | 0 | 2 | 1 | 0 | 0 | 0 | 2 |
| 0 | 1 | 0 | | | | | |
| 190: | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 0 | | | | | |
| 200: | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 0 | 0 | 1 | | | | | |
| 210: | 0 | 0 | 2 | 1 | 0 | 0 | 3 |
| 0 | 0 | 0 | | | | | |
| 220: | 1 | 1 | 0 | 0 | 0 | 3 | 0 |
| 1 | 2 | 2 | | | | | |
| 230: | 3 | 0 | 0 | 5 | 2 | 4 | 0 |
| 2 | 3 | 3 | | | | | |
| 240: | 1 | 0 | 0 | 0 | 0 | 228Th = ~~921~~ 1124 [3 | 4 |
| 1 | 3 | 4 | | | | | |
| 250: | 4 | 6 | 10 | 17 | 36 | 46 | 97 |
| 86 | 72 | 49 | | | | | |
| 260: | 25 | 21 | 7 | 9 | 14 | 18 | 24 |
| 45 | 76 | 129 | | | | | |
| 270: | 147 | 201 | 226 | 198 | 142 | 78 | 34 |
| 17 | 11 | 18 | | | | | |
| 280: | 17 | 14 | 19 | 12 | 23 | 17 | 12 |
| 13 | 13 | 18 | | | | | |

230Th = ~~7144~~ 7663

224Ra

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3 | 12 | 8 | | | | | |
| 300: | | 9 | 6 | 13 | 7 | 17 | 11 | 14 |
| | 5 | 10 | 8 | | | | | |
| 310: | | 13 | 11 | 17 | 22 | 43 | 58 | 58 |
| | 57 | 62 | 79 | | | | | |
| 320: | | 54 | 36 | 21 | 21 | 24 | 17 | 17 |
| | 23 | 19 | 21 | | | | | |
| 330: | | 15 | 26 | 16 | 8 | 12 | 5 | 4 |
| | 3 | 6 | 8 | | | | | |
| 340: | | 5 | 8 | 5 | 4 | 1 | 6 | 3 |
| | 3 | 3 | 4 | | | | | |
| 350: | | 0 | 4 | 4 | 3 | 1 | 1 | 0 |
| | 2 | 1 | 2 | | | | | |
| 360: | | 1 | 3 | 1 | 2 | 4 | 10 | 6 |
| | 10 | 8 | 12 | | | | | |
| 370: | | 9 | 9 | 6 | 5 | 6 | 9 | 10 |
| | 13 | 13 | 15 | | | | | |
| 380: | | 15 | 23 | 12 | 14 | 5 | 5 | 5 |
| | 4 | 2 | 6 | | | | | |
| 390: | | 4 | 5 | 6 | 0 | 3 | 3 | 1 |
| | 4 | 0 | 3 | | | | | |
| 400: | | 0 | 2 | 2 | 1 | 3 | 2 | 0 |
| | 8 | 1 | 4 | | | | | |
| 410: | | 3 | 9 | 3 | 10 | 6 | 15 | 10 |
| | 15 | 20 | 33 | | | | | |
| 420: | | 24 | 50 | 65 | 59 | 51 | 45 | 30 |
| | 17 | 5 | 9 | | | | | |
| 430: | | 3 | 0 | 4 | 1 | 2 | 2 | 0 |
| | 5 | 6 | 2 | | | | | |
| 440: | | 1 | 1 | 2 | 1 | 2 | 2 | 5 |
| | 2 | 5 | 2 | | | | | |
| 450: | | 3 | 1 | 1 | 0 | 1 | 0 | 3 |
| | 2 | 4 | 2 | | | | | |
| 460: | | 2 | 5 | 2 | 2 | 3 | 1 | 2 |
| | 9 | 4 | 6 | | | | | |
| 470: | | 5 | 5 | 6 | 6 | 5 | 8 | 6 |
| | 6 | 11 | 11 | | | | | |
| 480: | | 16 | 16 | 11 | 17 | 20 | 15 | 6 |
| | 6 | 4 | 9 | | | | | |
| 490: | | 5 | 3 | 3 | | | | |

11

~~679~~

898

## MEASUREMENT OF ACTIVITIES OF U & Th ISOTOPES

sample # **NOPI-ECP-28.3/13.0-Unspiked** Sep. date **3/4/93**
Analyst **B W L**

| sample weight(g) | spike weight(g) | U-232 (dpm/g) | Ref. date of spike | Days btwn ref. & sep. | U-232* (dpm/g) |
|---|---|---|---|---|---|
| 0.0483 | 2.7794 | 22.59 | 12/27/92 | 67 | *22.548331* |

Th228/U232 *0.379*

Counting time for Th = 1154.2 (min.)
Days btwn. sep. & count. = 4 (days)
*CF for Th-228* = *.9956*

Counting time for U = 3473.68 (min.)
Days btwn. sep. & count. = 5 (days)
*CF for U-232* = *1.0060*

| Th-232 counts | Th-230 counts | Th-228 counts | Ra-224 counts |
|---|---|---|---|
| 67 | 126668 | 85 | 108 |

| U-238 counts | U-234 counts | U-232 counts |
|---|---|---|
| 6473 | 6283 | 6000 |

| bkgd | bkgd | bkgd | bkgd |
|---|---|---|---|
| 0.002214 | 0.002214 | 0.026566 | 0.002214 |

| bkgd | bkgd | bkgd |
|---|---|---|
| 0.0048325 | 0.012564 | 0.00474 |

bkgd time 1 (min.)

bkgd time 1 (min.)

| Th-232* counts | Th-230* counts | Th-228 counts | Ra-224* counts |
|---|---|---|---|
| *64.4446* | *126665.445* | *48.962344* | *105.445* |

| U-238* counts | U-234* counts | U-232sp counts |
|---|---|---|
| *6456.2134* | *6239.36* | *5948* |

| | | | |
|---|---|---|---|
| U-238(dpm/g) = | **1.41E+03** | ± | **2.52E+01** |
| U-234(dpm/g) = | **1.36E+03** | ± | **2.46E+01** |
| Th-232(dpm/g) = | **6.47E+02** | ± | **1.06E+02** |
| Th-230(dpm/g) = | **1.27E+06** | ± | **1.38E+05** |
| U-234/U-238 = | **0.9664** | ± | **0.0171** |
| | | ± | |
| Th-230/Th-232 = | **1965.4935** | ± | **240.1867** |
| Th-228/Th-232 = | **0.7598** | ± | **0.1249** |

| Decay constant (m-1) | U-238 | Th-232 |
|---|---|---|
| | 2.94965E-16 | 9.4178E-17 |

**U (ppm) =** **1886.990**

**Th (ppm) =** **2647.759**

unspiked use for 234/238 ratio only Bret Leslie 3/12/93

MCB # 1 ACQ 03-09-93 AT 22:01:32 RT : 208421.0 LT : 208409.3
No detector description was entered
NOPI-ecp-28.3/13.0 Uranium unspiked

time = 3473.68 minutes

Day between sep & count = 5

ROI # 3-1 RANGE : 7 = 3.81MeV to 92 = 4.19MeV
AREA : Gross = 6473 Net = 6344 +/- 90
CENTROID : 79.08 = 4.13MeV
SHAPE : Fwhm = 0.03MeV Fwtm = 0.13MeV

ID : U-238 at 4.15MeV
Corrected Rate = 0.030 +/- 0.00

ROI # 3-2 RANGE : 94 = 4.20MeV to 126 = 4.34MeV
AREA : Gross = 288 Net = 201 +/- 24
CENTROID : 114.48 = 4.29MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.10MeV

ID : U-235 at 4.32MeV
Corrected Rate = 0.001 +/- 0.00

ROI # 3-3 RANGE : 131 = 4.37MeV to 215 = 4.74MeV
AREA : Gross = 6288 Net = 6173 +/- 88
CENTROID : 197.04 = 4.66MeV
SHAPE : Fwhm = 0.09MeV Fwtm = 0.17MeV

ID : ~~Th 230~~ U-234 at 4.69MeV
Corrected Rate = 0.030 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| -127: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | | | | | | |
| -110: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -100: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -90: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -80: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -70: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -60: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -50: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -40: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -30: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -20: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| -10: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 238U = 6473 | 3 | 3 | | | | |
| 10: | 4 | 0 | 3 | 2 | 2 | 8 | 2 |
| 7 | 4 | 4 | | | | | |
| 20: | 3 | 4 | 7 | 5 | 6 | 9 | 3 |
| 7 | 6 | 7 | | | | | |
| 30: | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12 | 13 | 14 | | | | | |
| 40: | 10 | 16 | 17 | 20 | 26 | 28 | 18 |
| 20 | 17 | 19 | | | | | |
| 50: | 33 | 27 | 42 | 46 | 40 | 34 | 50 |
| 56 | 49 | 67 | | | | | |
| 60: | 66 | 77 | 81 | 102 | 104 | 114 | 140 |
| 148 | 194 | 219 | | | | | |
| 70: | 227 | 260 | 240 | 235 | 215 | 210 | 253 |
| 294 | 408 | 446 | | | | | |
| 80: | 432 | 423 | 342 | 226 | 84 | 48 | 14 |
| 4 | 4 | 2 | | | | | |
| 90: | 0 | 0 | 3 | 3 | 0 | 2 | 3 |
| 3 | 6 | 3 | | | | | |
| 100: | 4 | 3 | 5 | 9 | 4 | 7 | 7 |
| 12 | 7 | 12 | | | | | |
| 110: | 8 | 7 | 12 | 12 | 14 | 24 | 10 |
| 12 | 23 | 10 | | | | | |
| 120: | 14 | 14 | 21 | 9 | 2 | 3 | 6 |
| 2 | 6 | 6 | | | | | |
| 130: | 3 | 2 | 3 | 2 | 7 | 3 | 6 |
| 3 | 10 | 3 | | | | | |
| 140: | 7 | 6 | 9 | 5 | 10 | 8 | 8 |
| 7 | 13 | 8 | | | | | |
| 150: | 14 | 5 | 3 | 10 | 13 | 13 | 11 |
| 12 | 14 | 21 | | | | | |
| 160: | 15 | 23 | 20 | 23 | 22 | 18 | 24 |
| 20 | 24 | 29 | | | | | |
| 170: | 32 | 34 | 36 | 34 | 43 | 55 | 63 |
| 57 | 64 | 79 | | | | | |
| 180: | 75 | 100 | 106 | 108 | 119 | 153 | 164 |
| 182 | 200 | 190 | | | | | |
| 190: | 208 | 220 | 226 | 191 | 210 | 226 | 244 |
| 231 | 280 | 283 | | | | | |
| 200: | 303 | 317 | 327 | 283 | 192 | 117 | 47 |
| 18 | 6 | 2 | | | | | |
| 210: | 1 | 2 | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | | | | | |
| 220: | 2 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | | | | | |
| 230: | 0 | 1 | 2 | 0 | 1 | 0 | 1 |
| 1 | 1 | 2 | | | | | |
| 240: | 0 | 3 | 2 | 2 | 0 | 0 | 0 |
| 2 | 2 | 1 | | | | | |
| 250: | 2 | 2 | 2 | 3 | 2 | 0 | 2 |
| 0 | 1 | 3 | | | | | |
| 260: | 1 | 2 | 1 | 1 | 0 | 0 | 3 |
| 2 | 0 | 0 | | | | | |
| 270: | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 2 | | | | | |
| 280: | 1 | 1 | 0 | 0 | 0 | 2 | 0 |
| 0 | 1 | 0 | | | | | |
| 290: | 2 | 0 | 2 | 1 | 1 | 0 | 0 |
| 0 | 1 | 2 | | | | | |
| 300: | 0 | 0 | 0 | 2 | 2 | 2 | 0 |
| 2 | 3 | 1 | | | | | |
| 310: | 2 | 2 | 1 | 1 | 1 | 0 | 4 |
| 3 | 1 | 0 | | | | | |
| 320: | 0 | 5 | 1 | 3 | 2 | 0 | 3 |
| 3 | 3 | 0 | | | | | |
| 330: | 4 | 4 | 7 | 3 | 5 | 4 | 4 |
| 1 | 3 | 4 | | | | | |
| 340: | 5 | 2 | 5 | 4 | 2 | 4 | 5 |
| 6 | 5 | 4 | | | | | |
| 350: | 2 | 3 | 2 | 1 | 2 | 1 | 0 |
| 2 | 0 | 0 | | | | | |

$U^{234}$ 11

6203

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | | | | |
| 370: | | 1 | 2 | 0 | 0 | 2 | 0 | 0 |
| | 1 | 1 | 0 | | | | |
| 380: | | 3 | 1 | 2 | 2 | 5 | | |

Background time = 3104 minutes
Background ACQ 02-08-93
ch # 3

Bret Leslie
3/11/93

k0GMCB # 1 ACQ 03-08-93 AT 17:24:23 RT : 69253.7 LT : 69249.7
No detector description was entered
NOPI-ECP-28.3/13.0 Thorium unspiked

Mass of sample = 0.0483 grams
time = 1154.2 minutes
mass of spike = 0.0g
days between separation & count = 5 days

ROI # 6-1 RANGE : 15 = 3.85MeV to 47 = 4.04MeV
AREA : Gross = 67 Net = 32 +/- 14
CENTROID : 39.43 = 3.99MeV
SHAPE : Fwhm = 0.02MeV Fwtm = 0.05MeV

ID : Th-232 at 4.01MeV
Corrected Rate = 0.000 +/- 0.00

ROI # 6-2 RANGE : 90 = 4.28MeV to 171 = 4.75MeV
AREA : Gross = 126668 Net = 125835 +/- 369
CENTROID : 160.24 = 4.69MeV
SHAPE : Fwhm = 0.04MeV Fwtm = 0.13MeV

ID : Th-230 at 4.69MeV
Corrected Rate = 1.817 +/- 0.01

ROI # 6-3 RANGE : 173 = 4.76MeV to 185 = 4.83MeV
AREA : Gross = 107 Net = 29 +/- 11
Could not properly fit the peak.

ROI # 6-4 RANGE : 269 = 5.31MeV to 302 = 5.50MeV
AREA : Gross = 84 Net = 11 +/- 19
228Th @ 288
CENTROID : 292.69 = 5.45MeV
SHAPE : Fwhm = 0.01MeV Fwtm = 0.03MeV

ID : No close library match

ROI # 6-5 RANGE : 304 = 5.51MeV to 412 = 6.13MeV
AREA : Gross = 5323 Net = 4914 +/- 109
CENTROID : 396.36 = 6.04MeV
SHAPE : Fwhm = 0.11MeV Fwtm = 0.16MeV

ID : Th-227 at 6.04MeV
Corrected Rate = 0.071 +/- 0.00

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | | | | | |
| 10: | 1 | 1 | 0 | 1 | 1 | 0 | [4 |
| 0 | 2 | 0 | | | | | |
| 20: | 1 | 2 | 1 | 1 | 2 | 0 | 2 |
| 1 | 1 | 5 | | | | | |
| 30: | 1 | 1 | 1 | 0 | 1 | 0 | 4 |
| 2 | 7 | 5 | | | | | |
| 40: | 5 | 5 | 2 | 3 | 4 | 2 | 2] |
| 0 | 2 | 2 | | | | | |
| 50: | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| 2 | 0 | 5 | | | | | |
| 60: | 1 | 2 | 0 | 5 | 9 | 5 | 14 |
| 6 | 7 | 6 | | | | | |
| 70: | 10 | 18 | 9 | 13 | 23 | 9 | 13 |
| 8 | 12 | 3 | | | | | |
| 80: | 0 | 2 | 3 | 1 | 2 | 3 | 3 |
| 2 | 3 | 1 | | | | | |
| 90: | 0 | [6 | 5 | 6 | 6 | 7 | 9 |
| 9 | 6 | 10 | | | | | |
| 100: | 12 | 9 | 9 | 13 | 11 | 12 | 14 |
| 18 | 21 | 14 | | | | | |
| 110: | 30 | 35 | 28 | 26 | 47 | 38 | 49 |
| 49 | 54 | 71 | | | | | |
| 120: | 67 | 70 | 76 | 101 | 98 | 108 | 95 |
| 105 | 107 | 114 | | | | | |
| 130: | 119 | 144 | 162 | 177 | 201 | 212 | 224 |
| 290 | 308 | 369 | | | | | |
| 140: | 481 | 652 | 759 | 1113 | 1516 | 2000 | 2581 |
| 3184 | 3787 | 4120 | | | | | |
| 150: | 3837 | 3595 | 3214 | 3046 | 3166 | 3785 | 4949 |
| 6582 | 8617 | 10235 | | | | | |
| 160: | 11374 | 11189 | 9847 | 7825 | 5639 | 3256 | 1687 |
| 616 | 195 | 29 | | | | | |
| 170: | 16 | 5] | 11 | 11 | 7 | 14 | 16 |
| 13 | 12 | 13 | | | | | |
| 180: | 10 | 4 | 3 | 1 | 3 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 190: | 0 | 0 | 0 | 1 | 2 | 0 | 1 |
| 0 | 0 | 0 | | | | | |
| 200: | 0 | 1 | 3 | 3 | 4 | 5 | 5 |
| 6 | 2 | 3 | | | | | |
| 210: | 8 | 6 | 3 | 5 | 5 | 5 | 5 |
| 9 | 8 | 11 | | | | | |
| 220: | 9 | 7 | 6 | 12 | 9 | 6 | 7 |
| 4 | 4 | 2 | | | | | |
| 230: | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | | | | | |
| 240: | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | | | | | |
| 250: | 0 | 0 | 1 | 1 | 0 | 0 | 3 |
| 1 | 0 | 0 | | | | | |
| 260: | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | | | | | |
| 270: | [1 | 1 | 2 | 2 | 0 | 1 | 1 |
| 3 | 0 | 1 | | | | | |
| 280: | 3 | 0 | 1 | 1 | 0 | 2 | 1 |
| 1 | 3 | 4 | | | | | |
| 290: | 5 | 4 | 7 | 8 | 2 | 3 | 6 |
| 4 | 4 | 2 | | | | | |
| 300: | 4 | 4 | 3 | 1] | 0 | 3 | 7 |

232 Th = 67

230 Th = 126668

228 Th = 85

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 310: | 4 | 8 | 10 | Rg=100 | 4 | 5 | 7 | 5 |
| 4 | 11 | 12 | | | | | | |
| 320: | 5 | 8 | 8 | 15 | 12 | 14 | 17 | 12 |
| 18 224 Rg | 9 ] | 14 | | | | | | |
| 330: | 9 | 14 | 13 | BWL 3/12/93 | 12 | 21 | 20 | 28 |
| 35 | 41 | 53 | | | | | | |
| 340: | 76 | 89 | 116 | | 108 | 133 | 121 | 145 |
| 118 | 90 | 114 | | | | | | |
| 350: | 122 | 119 | 133 | | 101 | 112 | 78 | 83 |
| 49 | 39 | 29 | | | | | | |
| 360: | 18 | 7 | 19 | | 15 | 7 | 11 | 9 |
| 10 | 7 | 12 | | | | | | |
| 370: | 19 | 17 | 8 | | 20 | 19 | 19 | 16 |
| 18 | 18 | 25 | | | | | | |
| 380: | 22 | 14 | 20 | | 26 | 31 | 42 | 39 |
| 71 | 88 | 101 | | | | | | |
| 390: | 123 | 147 | 130 | | 140 | 117 | 107 | 109 |
| 125 | 113 | 120 | | | | | | |
| 400: | 120 | 135 | 140 | | 137 | 120 | 97 | 84 |
| 42 | 30 | 12 | | | | | | |
| 410: | 8 | 1 | 3 | | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | | | | | | |
| 420: | 0 | 1 | 0 | | 1 | 0 | 0 | 2 |
| 0 | 0 | 2 | | | | | | |
| 430: | 2 | 0 | 1 | | 2 | 1 | 1 | 0 |
| 1 | 1 | 3 | | | | | | |
| 440: | 1 | 4 | 3 | | 7 | 4 | 8 | 5 |
| 8 | 1 | 2 | | | | | | |
| 450: | 4 | 2 | 1 | | 1 | 0 | 1 | 1 |
| 0 | 0 | 1 | | | | | | |
| 460: | 1 | 2 | 1 | | 3 | 0 | 1 | 0 |
| 5 | 4 | 2 | | | | | | |
| 470: | 1 | 6 | 0 | | 5 | 0 | 1 | 1 |
| 2 | 2 | 1 | | | | | | |
| 480: | 1 | 3 | 0 | | 3 | 0 | 1 | 1 |
| 3 | 1 | 2 | | | | | | |
| 490: | 3 | 10 | 2 | | 13 | 7 | 3 | 10 |
| 6 | 8 | 5 | | | | | | |
| 500: | 64 | 75 | 89 | | 86 | 74 | 78 | 72 |
| 85 | 64 | 60 | | | | | | |
| 510: | 60 | 13 | | | | | | |

k0G

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | NOPI-ECP-28.3./13.0 | | | | | | | | | |
| Weight(g) | 4.1208 | Geometry | 7.0 cm | | | Counting Time(min) | | 10 | | |
| time of background minutes | | | 4320 | | | | | | | |
| Nuclides | Total Counts | Bkgd(1) | Blank(2) (cpm) | Eblank cpm | Net counts | c. eff. (%) | intensity (%) | Activity (dpm/g) | | |
| Pb-210 | 45 kev | | | | | | | | | |
| 210 | 4106 | 3105 | 0.22875 | 0.00976 | 998.7125 | 1.303 | 4.1 | 45366.02 | ± | 59.23 |
| Th-234 | 62 kev | | | | | | | | | |
| 62 | 7208 | 4095 | 0.3742 | 0.01249 | 3109.258 | 3.023 | 5.7 | 43788.72 | ± | 10.41 |
| (93Kev) | | | | | | | | | | |
| 93 | 9717 | 4266 | 0.95625 | 0.01996 | 5441.4375 | 7.122 | 6.8 | 27265.99 | ± | 2.80 |
| Ra-226 | | | | | | | | | | |
| 295 | 14187 | 1083 | 0.07625 | 0.00564 | 13103.2375 | 4.933 | 18 | 35810.75 | ± | 0.98 |
| 352 | 22609 | 1019 | 0.0122 | 0.0029 | 21589.878 | 4.251 | 35 | 35213.53 | ± | 0.46 |
| 609 | 15007 | 454 | 0.0102 | 0.0026 | 14552.898 | 2.305 | 43 | 35631.05 | ± | 0.84 |
| 183.7 | 10711 | 2594 | 0.46375 | 0.0139 | 8112.3625 | 13.15 | 3.3 | 45365.54 | ± | 2.56 |
| Th-228 | 583 kev | | | | | | | | | |
| 228 | 321 | 444 | 0.2004 | 0.00914 | -125.004 | 0.79 | 86 | -446.50 | ± | -13.16 |
| Ra-228 | | | | | | | | | | |
| 338 | 1005 | 954 | 0.08375 | 0.00591 | 50.1625 | 3.898 | 12 | 260.24 | ± | 30.18 |
| 911 | 246 | 246 | 0.2104 | 0.00936 | -2.104 | 1.511 | 29 | -11.65 | ± | -157.33 |
| 964 | 445 | 386 | 0.17083 | 0.00844 | 57.2917 | 1.623 | 21.8 | 392.95 | ± | 37.34 |
| Ra-226 weighted average = | | | 35590.00 | ± | 0.51 | U (ppm)= | | 47641 | ± | 0.68 |
| Ra-228 weighted average = | | | 305.62 | ± | 23.22 | Th (ppm) = | | 1131 | ± | 85.9 |
| 210PB/234Th av = | | | 28418.00 | ± | 2.7 | U (ppm)= | | 38040 | ± | 3.61 |
| | 63&92kev | | | | | | | | | |
| Ra-228 av&Th228 = | | | -263.60 | ± | 11.45 | Th (ppm) = | | -975 | ± | 42.4 |
| Calculation of weighted average (up to 200 data sets can be input) | | | | | | | | | | |
| | weighted average= | | 35590.4 | | average= | 38737 | | | | |
| | weighted error= | | 0.36918 | | std.= | 5745 | | | | |
| data | ± | err | error^2 | 1/error^2 | data/error^2 | | | | | |
| 35811 | ± | 0.98 | 0.9604 | 1.041233 | 37287.6 | | | | | |
| 35214 | ± | 0.46 | 0.2116 | 4.725898 | 166418 | | | | | |
| 35631 | ± | 0.84 | 0.7056 | 1.417234 | 50497.4 | | | | | |
| 45366 | ± | 2.56 | 6.5536 | 0.152588 | 6922.3 | | | | | |

| Sample sheet | NOPI-ECP-28.3/13.0 | | | *DATE* | 3/1/93 | *TIME (MIN)* | 10 |
|---|---|---|---|---|---|---|---|
| Isotope | E. (Kev) | Channels | Back Chan. | Counts | Back Count | Net Count | **CPM** |
| 210 Pb | 45 | 89-94 | 86-88 | **4106** | **3105** | **1001** | 0.94 |
| | | | 95-97 | 7211 | | | |
| | | | | | | | |
| 234 Th | 63 | 122-127 | 119-121 | **7208** | **4095** | **3113** | 2.93 |
| | | | 128-130 | 11303 | | | |
| | | | | | | | |
| 234 Th | 92 | 182-186 | 180-181 | **9717** | **4266** | **5451** | 5.13 |
| | | | 187-189 | 13983 | | | |
| | | | | | | | |
| 226Ra/235U | 186 | 367-372 | 364-366 | **10711** | **2594** | **8117** | 7.64 |
| | | | 373-375 | 13305 | | | |
| | | | | | | | |
| 212 Pb | 238 | | | | | | |
| 224 Ra | 239 | | | | | | |
| 214 Pb | 242 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 214 Pb | 295 | 585-592 | 581-584 | **14187** | **1083** | **13104** | 12.33 |
| | | | 593-596 | 15270 | | | |
| | | | | | | | |
| 228 Ac | 338 | 671-678 | 667-670 | **1005** | **954** | **51** | 0.05 |
| | | | 679-682 | 1959 | | | |
| | | | | | | | |
| 214 Pb | 352 | 698-705 | 694-697 | **22609** | **1019** | **21590** | 20.31 |
| | | | 706-709 | 23628 | | | |
| | | | | | | | |
| 208 Tl | 583 | 1160-1167 | 1156-1159 | **321** | **444** | **-123** | -0.12 |
| | | | 1168-1171 | 765 | | | |
| | | | | | | | |
| 214 Bi | 609 | 1213-1220 | 1209-1212 | **15007** | **454** | **14553** | 13.69 |
| | | | 1221-1224 | 15461 | | | |
| | | | | | | | |
| 228 Ac | 911 | 1816-1823 | 1813-1815 | **246** | **246** | **0** | 0.00 |
| | | | 1824-1828 | 492 | | | |
| | | | | | | | |
| 228 Ac | 964 | 1924-1941 | 1915-1923 | **445** | **386** | **59** | 0.06 |
| 228Ac | 969 | | 1942-1950 | 831 | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

MCA #1 - Canberra S100 - 28301300.MCA - NOPI-ECP-28.3/13.0

Tag Number: 83
Report Group: 2/4
Group Size: 4096

Readout: Mon 01 Mar 1993 @ 08:42:23
Acquire Started: Mon 01 Mar 1993 @ 08:30:13

Elapsed Live Time: 600.00 sec.
Elapsed True Time: 605.88 sec.
Dead Time: 0.97 %

MCA Mode: PHA+
Preset Conditions: Live Time = 600 sec.
Area = 20000 cts., Ch. 667 to 682

Calibration: 0.0000*Ch^2 + 0.4996*Ch + 1.083 keV

Area Statistics: Background Channels = 4
% Error Sigma = 1.65

Peak Statistics: Sensitivity Factor = 5.0
Expected FWHM (ch) = 2.7 - 6.0

Iso. Id. Criteria: Energy Window = +-1.000 keV
Iso. Library: C:\WINDOWS\S100\SPECTRAN.ISO

4,1208 grams
$\Delta t$ = 10 minutes
3/1/93
BWL

Int: CTS + BACK

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) |
|---|---|---|---|---|
| 1 | 43.6 | 7211 | 794 | 46.6 |
| | 49.0 | 12.02 | 13.15 | 1.25 |
| 2 | 60.5 | 11303 | 2926 | 63.5 |
| | 66.0 | 18.84 | 4.76 | 1.35 |
| | Isotope: | TH-234 | @ 63.3 | |
| 3 | 90.5 | 13983 | 3297 | 92.7 |
| | 95.0 | 23.31 | 3.87 | 1.19 |
| 4 | 181.9 | 13305 | 8117 | 186.0 |
| | 189.4 | 22.17 | 2.34 | 1.46 |
| | Isotope: | U-235 | @ 185.7 | |
| 5 | 291.4 | 15270 | 13104 | 295.0 |
| | 298.9 | 25.45 | 1.56 | 1.51 |
| | Isotope: | PB-214 | @ 295.2 | |
| 6 | 334.3 | 1959 | 51 | 338.1 |
| | 341.8 | 3.27 | 143.20 | 0.97 |
| | Isotope: | AC-228 | @ 338.3 | |
| 7 | 347.8 | 23628 | 21590 | 351.7 |
| | 355.3 | 39.38 | 1.17 | 1.53 |
| | Isotope: | PB-214 | @ 351.9 | |
| 8 | 579.2 | 765 | -123 | 579.8 |
| | 586.7 | 1.27 | 37.10 | 21458958.00 |
| 9 | 605.1 | 15461 | 14553 | 608.7 |
| | 612.6 | 25.77 | 1.41 | 1.70 |
| | Isotope: | XE-135 | @ 608.1 | |
| | | BI-214 | @ 609.3 | |
| 10 | 906.9 | 492 | 0 | 911.4 |
| | 914.4 | 0.82 | 0.00 | 0.67 |
| | Isotope: | AC-228 | @ 911.2 | |
| 11 | 958.9 | 831 | 83 | 963.4 |
| | 974.4 | 1.38 | 95.90 | 1.84 |

# REGION OF INTEREST DATA

ROI # 1

| Channel # | **** Data **** | | | | |
|---|---|---|---|---|---|
| 85 | 536 | 508 | 509 | 542 | 546 |
| 90 | 724 | 883 | 780 | 631 | 508 |
| 95 | 535 | 509 | | | |

# REGION OF INTEREST DATA

ROI # 2

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 119 | | | | | 673 |
| 120 | 687 | 714 | 699 | 1040 | 1612 |
| 125 | 1786 | 1280 | 791 | 643 | 709 |
| 130 | 669 | | | | |

ROI # 3

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 179 | | | | | 878 |
| 180 | 660 | 892 | 1791 | 2839 | 2595 |
| 185 | 1535 | 957 | 973 | 863 | |

ROI # 4

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 362 | | | 327 | 329 | 358 |
| 365 | 346 | 345 | 479 | 972 | 2073 |
| 370 | 2963 | 2278 | 1080 | 521 | 334 |
| 375 | 320 | 280 | 300 | | |

ROI # 5

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 581 | | 138 | 137 | 130 | 153 |
| 585 | 223 | 725 | 2314 | 4131 | 4070 |
| 590 | 1961 | 591 | 172 | 129 | 117 |
| 595 | 134 | 145 | | | |

ROI # 6

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 667 | | | 121 | 138 | 125 |
| 670 | 94 | 118 | 112 | 121 | 140 |
| 675 | 144 | 116 | 124 | 130 | 117 |
| 680 | 122 | 119 | 118 | | |

ROI # 7

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 694 | | | | | 117 |
| 695 | 156 | 144 | 160 | 245 | 859 |
| 700 | 2832 | 5819 | 6806 | 4220 | 1488 |
| 705 | 340 | 144 | 104 | 85 | 109 |

ROI # 8

| Channel # | | **** Data **** | | | |
|---|---|---|---|---|---|
| 1157 | | | 83 | 73 | 65 |
| 1160 | 57 | 41 | 35 | 50 | 49 |
| 1165 | 31 | 44 | 43 | 28 | 42 |
| 1170 | 37 | 44 | 43 | | |

# REGION OF INTEREST DATA

ROI # 9

| Channel # | | | **** Data **** | | |
|---|---|---|---|---|---|
| 1209 | | | | | 57 |
| 1210 | 45 | 59 | 92 | 374 | 1236 |
| 1215 | 2895 | 4115 | 3693 | 1930 | 627 |
| 1220 | 137 | 63 | 49 | 40 | 49 |

ROI # 10

| Channel # | | | **** Data **** | | |
|---|---|---|---|---|---|
| 1813 | | | | 42 | 28 |
| 1815 | 34 | 37 | 33 | 42 | 24 |
| 1820 | 25 | 28 | 40 | 29 | 25 |
| 1825 | 22 | 30 | 30 | 23 | |

ROI # 11

| Channel # | | | **** Data **** | | |
|---|---|---|---|---|---|
| 1917 | | | 23 | 19 | 20 |
| 1920 | 23 | 23 | 32 | 21 | 40 |
| 1925 | 40 | 51 | 44 | 37 | 25 |
| 1930 | 27 | 25 | 25 | 20 | 17 |
| 1935 | 21 | 30 | 24 | 21 | 16 |
| 1940 | 22 | 28 | 20 | 17 | 18 |
| 1945 | 25 | 31 | 26 | 20 | |

MCA #1 - Canberra S100 - 28301300.MCA - bACKGROUND 28.3/13.0

Tag Number: 83
Report Group: 1/4
Group Size: 4096

Readout: Mon 01 Mar 1993 @ 08:44:04
Acquire Started: Mon 01 Mar 1993 @ 08:30:13

Elapsed Live Time: 0.17 hr.
Elapsed True Time: 0.17 hr.
Dead Time: 0.97 %

MCA Mode: PHA+
Preset Conditions: Live Time = 56.00 hr.

Calibration: 0.0000*Ch^2 + 0.4996*Ch + 1.083 keV

Area Statistics: Background Channels = 4
% Error Sigma = 1.65

Peak Statistics: Sensitivity Factor = 5.0
Expected FWHM (ch) = 2.7 - 6.0

Iso. Id. Criteria: Energy Window = +-1.000 keV
Iso. Library: C:\WINDOWS\S100\SPECTRAN.ISO

BWL
3/1/93
$\Delta t$ = 10 minutes

Integral = BACK

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) | |
|---|---|---|---|---|---|
| 1 | 43.6 | 1553 | 0 | 214.2 | |
| | 44.6 | 2.59 | 0.00 | 5.58 | Back= 3105 |
| 2 | 48.0 | 1552 | 0 | 218.7 | |
| | 49.0 | 2.59 | 0.00 | 5.58 | |
| 3 | 60.5 | 2074 | 0 | 231.1 | |
| | 61.5 | 3.46 | 0.00 | 5.58 | Back= 4095 |
| 4 | 65.0 | 2021 | 0 | 235.6 | |
| | 66.0 | 3.37 | 0.00 | 5.58 | |
| | Isotope: | I-134 | @ 235.5 | | |
| 5 | 90.5 | 2430 | 0 | 261.1 | |
| | 91.5 | 4.05 | 0.00 | 5.58 | Back= 4266 |
| 6 | 94.5 | 1836 | 0 | 265.1 | |
| | 95.0 | 3.06 | 0.00 | 5.58 | |
| | Isotope: | GE-75 | @ 264.7 | | |
| | | SE-75 | @ 264.7 | | |
| 7 | 181.9 | 1360 | 0 | 183.0 | |
| | 183.4 | 2.27 | 0.00 | 5.58 | Back= 2594 |
| 8 | 187.9 | 1234 | 0 | 188.4 | |
| | 189.4 | 2.06 | 0.00 | 21458958.00 | |
| 9 | 291.4 | 558 | 0 | 291.9 | |
| | 292.9 | 0.93 | 0.00 | 21458958.00 | Back= 1083 |
| 10 | 297.4 | 525 | 0 | 298.4 | |
| | 298.9 | 0.88 | 0.00 | 21458958.00 | |
| | Isotope: | GA-73 | @ 297.4 | | |
| 11 | 334.3 | 478 | 0 | 334.8 | |
| | 335.8 | 0.80 | 0.00 | 21458958.00 | Back= 954 |
| | Isotope: | NP-239 | @ 334.3 | | |
| 12 | 340.3 | 476 | 0 | 340.8 | |
| | 341.8 | 0.79 | 0.00 | 21458958.00 | |
| | Isotope: | CS-136 | @ 340.6 | | |
| 13 | 347.8 | 577 | 0 | 348.4 | |
| | 349.3 | 0.96 | 0.00 | 21458958.00 | Back= 1019 |
| 14 | 353.8 | 442 | 0 | 354.2 | |
| | 355.3 | 0.74 | 0.00 | 21458958.00 | |

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) | |
|---|---|---|---|---|---|
| 15 | 579.2 | 278 | 0 | 579.6 | Back= 444 |
| | 580.7 | 0.46 | 0.00 | 21458958.00 | |
| 16 | 585.2 | 166 | 0 | 586.2 | |
| | 586.7 | 0.28 | 0.00 | 21458958.00 | |
| 17 | 605.1 | 253 | 0 | 606.3 | Back= 454 |
| | 606.6 | 0.42 | 0.00 | 21458958.00 | |
| | | Isotope: SB-125 @ 606.7 | | | |
| 18 | 611.1 | 201 | 0 | 612.1 | |
| | 612.6 | 0.34 | 0.00 | 21458958.00 | |
| 19 | 906.9 | 141 | 0 | 908.0 | Back: 246 |
| | 908.4 | 0.23 | 0.00 | 21458958.00 | |
| 20 | 912.9 | 105 | 0 | 913.9 | |
| | 914.4 | 0.17 | 0.00 | 21458958.00 | |
| 21 | 958.9 | 201 | 0 | 961.4 | Back= 386 |
| | 962.4 | 0.34 | 0.00 | 0.23 | |
| 22 | 970.9 | 185 | 0 | 973.4 | |
| | 974.4 | 0.31 | 0.00 | 0.53 | |

BaSO4 NOPI-ECP-28.3/13.0

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | BaSO4 ofNOPI-ECP-28.3./ | | | | | | | | | |
| Weight(g) | 0.0511 | Geometry | 7.0 cm | | | Counting Time(min) | | 4140 | | |
| time of background minutes | | | 4320 | | | | | | | |
| Nuclides | Total Counts | Bkgd(1) | Blank(2) (cpm) | Eblank cpm | Net counts | c. eff. (%) | intensity (%) | Activity (dpm/g) | | |
| Pb-210 | 45 kev | | | | | | | | | |
| 210 | 12398 | 10478 | 0.22875 | 0.00976 | 972.975 | 1.303 | 4.1 | 8608.99 | ± | 60.01 |
| Th-234 | 62 kev | | | | | | | | | |
| 62 | 16365 | 11843 | 0.3742 | 0.01249 | 2972.812 | 3.023 | 5.7 | 8155.17 | ± | 10.64 |
| (93Kev) | | | | | | | | | | |
| 93 | 26006 | 12635 | 0.95625 | 0.01996 | 9412.125 | 7.122 | 6.8 | 9186.62 | ± | 2.13 |
| Ra-226 | | | | | | | | | | |
| 295 | 39924 | 6645 | 0.07625 | 0.00564 | 32963.325 | 4.933 | 18 | 17547.94 | ± | 0.62 |
| 352 | 63797 | 5553 | 0.0122 | 0.0029 | 58193.492 | 4.251 | 35 | 18488.17 | ± | 0.28 |
| 609 | 41284 | 2935 | 0.0102 | 0.0026 | 38306.772 | 2.305 | 43 | 18269.01 | ± | 0.52 |
| 183.7 | 39428 | 12729 | 0.46375 | 0.0139 | 24779.075 | 13.15 | 3.3 | 26991.32 | ± | 1.46 |
| Th-228 | 583 kev | | | | | | | | | |
| 228 | 3450 | 2961 | 0.2004 | 0.00914 | -340.656 | 0.79 | 86 | -237.01 | ± | -7.97 |
| Ra-228 | | | | | | | | | | |
| 338 | 6401 | 5630 | 0.08375 | 0.00591 | 424.275 | 3.898 | 12 | 428.75 | ± | 10.38 |
| 911 | 2539 | 1847 | 0.2104 | 0.00936 | -179.056 | 1.511 | 29 | -193.15 | ± | -17.05 |
| 964 | 3983 | 3319 | 0.17083 | 0.00844 | -43.2362 | 1.623 | 21.8 | -57.76 | ± | -42.98 |
| Ra-226 weighted average = | | | 18525.60 | ± | 0.23 | U (ppm)= | | 24798 | ± | 0.31 |
| Ra-228 weighted average = | | | 247.59 | ± | 8.68 | Th (ppm) = | | 916.1 | ± | 32.1 |
| 210PB/234Th av = | | | 9146.30 | ± | 2.7 | U (ppm)= | | 12243 | ± | 3.61 |
| | 63&92kev | | | | | | | | | |
| Ra-228 av&Th228 = | | | -15.43 | ± | 5.87 | Th (ppm) = | | -57.1 | ± | 21.7 |
| Calculation of weighted average (up to 200 data sets can be input) | | | | | | | | | | |
| | weighted average= | | 18525.6 | | average= | 21249 | | | | |
| | weighted error= | | 0.22632 | | std.= | 4974 | | 8609 | ± | 60 |
| data | ± | err | error^2 | 1/error^2 | data/error^2 | | | | | |
| 17548 | ± | 0.62 | 0.3844 | 2.601457 | 45650.4 | | | | | |
| 18488 | ± | 0.28 | 0.0784 | 12.7551 | 235816 | | | 8155 | ± | 10.6 |
| 18269 | ± | 0.52 | 0.2704 | 3.698225 | 67562.9 | | | | | |
| 26991 | ± | 1.46 | 2.1316 | 0.469131 | 12662.3 | | | 9187 | ± | 2.13 |

3/12/93

Bret Leslie Note
BaSO4 NOT
in equilibrium
w/r/t 228Ra or 226Ra!

| Sample sheet | NOPI-ECP-28.3/13.0 BaSO4 | | | *DATE* | 3/8/93 | *TIME (MIN)* | 4140 |
|---|---|---|---|---|---|---|---|
| Isotope | E. (Kev) | Channels | Back Chan. | Counts | Back Count | Net Count | **CPM** |
| 210 Pb | 45 | 89-94 | 86-88 | **12398** | **10478** | **1920** | 1.81 |
| | | | 95-97 | 22876 | | | |
| | | | | | | | |
| 234 Th | 63 | 122-127 | 119-121 | **16365** | **11843** | **4522** | 4.25 |
| | | | 128-130 | 28208 | | | |
| | | | | | | | |
| 234 Th | 92 | 182-186 | 180-181 | **26006** | **12635** | **13371** | 12.58 |
| | | | 187-189 | 38641 | | | |
| | | | | | | | |
| 226Ra/235U | 186 | 367-372 | 364-366 | **39428** | **12729** | **26699** | 25.12 |
| | | | 373-375 | 52157 | | | |
| | | | | | | | |
| 212 Pb | 238 | | | | | | |
| 224 Ra | 239 | | | | | | |
| 214 Pb | 242 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 214 Pb | 295 | 585-592 | 581-584 | **39924** | **6645** | **33279** | 31.31 |
| | | | 593-596 | 46569 | | | |
| | | | | | | | |
| 228 Ac | 338 | 671-678 | 667-670 | **6401** | **5630** | **771** | 0.73 |
| | | | 679-682 | 12031 | | | |
| | | | | | | | |
| 214 Pb | 352 | 698-705 | 694-697 | **63797** | **5553** | **58244** | 54.79 |
| | | | 706-709 | 69350 | | | |
| | | | | | | | |
| 208 Tl | 583 | 1160-1167 | 1156-1159 | **3450** | **2961** | **489** | 0.46 |
| | | | 1168-1171 | 6411 | | | |
| | | | | | | | |
| 214 Bi | 609 | 1213-1220 | 1209-1212 | **41284** | **2935** | **38349** | 36.08 |
| | | | 1221-1224 | 44219 | | | |
| | | | | | | | |
| 228 Ac | 911 | 1816-1823 | 1813-1815 | **2539** | **1847** | **692** | 0.65 |
| | | | 1824-1828 | 4386 | | | |
| | | | | | | | |
| 228 Ac | 964 | 1924-1941 | 1915-1923 | **3983** | **3319** | **664** | 0.62 |
| 228Ac | 969 | | 1942-1950 | 7302 | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

MCA #1 - Canberra S100 - 283130A.MCA - NOPI-ECP-28.3/13.0 BaSO4

Tag Number: 87
Report Group: 2/4
Group Size: 4096

Readout: Mon 08 Mar 1993 @ 09:47:19
Acquire Started: Mon 08 Mar 1993 @ 09:46:30

Elapsed Live Time: 4140.00 min.
Elapsed True Time: 4140.64 min.
Dead Time: 0.02 %

MCA Mode: PHA+
Preset Conditions: Live Time = 4140.00 min.
Area = 20000 cts., Ch. 667 to 682

Calibration: 0.0000*Ch^2 + 0.4996*Ch + 1.083 keV

Area Statistics: Background Channels = 4
% Error Sigma = 1.65

Peak Statistics: Sensitivity Factor = 5.0
Expected FWHM (ch) = 2.7 - 6.0

Iso. Id. Criteria: Energy Window = +-1.000 keV
Iso. Library: C:\WINDOWS\S100\SPECTRAN.ISO

Bret Leslie
3/11/93
$\Delta t$ = 4140 minutes
mass = 0.0511 grams

Integral = CTS + BACK

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) |
|---|---|---|---|---|
| 1 | 43.6 | 22876 | 1585 | 46.8 |
| | 49.0 | 0.09 | 11.51 | 1.13 |
| 2 | 60.5 | 28208 | 4138 | 63.3 |
| | 66.0 | 0.11 | 5.07 | 1.23 |
| | Isotope: | TH-234 | @ 63.3 | |
| 3 | 90.5 | 38641 | 8044 | 92.8 |
| | 95.0 | 0.16 | 2.57 | 1.26 |
| 4 | 181.9 | 52157 | 26699 | 186.3 |
| | 189.4 | 0.21 | 1.41 | 1.46 |
| | Isotope: | U-235 | @ 185.7 | |
| 5 | 291.4 | 46569 | 33279 | 295.2 |
| | 298.9 | 0.19 | 1.07 | 1.49 |
| | Isotope: | PB-214 | @ 295.2 | |
| 6 | 334.3 | 12031 | 771 | 338.1 |
| | 341.8 | 0.05 | 23.47 | 1.57 |
| | Isotope: | AC-228 | @ 338.3 | |
| 7 | 347.8 | 69350 | 58244 | 351.8 |
| | 355.3 | 0.28 | 0.75 | 1.55 |
| | Isotope: | PB-214 | @ 351.9 | |
| 8 | 579.2 | 6411 | 489 | 582.7 |
| | 586.7 | 0.03 | 27.02 | 1.66 |
| | Isotope: | TL-208 | @ 583.2 | |
| 9 | 605.1 | 44219 | 38349 | 608.9 |
| | 612.6 | 0.18 | 0.90 | 1.78 |
| | Isotope: | XE-135 | @ 608.1 | |
| | | BI-214 | @ 609.3 | |
| 10 | 906.9 | 4386 | 692 | 910.4 |
| | 914.4 | 0.02 | 15.79 | 1.74 |
| | Isotope: | AC-228 | @ 911.2 | |
| 11 | 958.9 | 7302 | 874 | 968.1 |
| | 974.4 | 0.03 | 26.80 | 1.65 |

# REGION OF INTEREST DATA

ROI # 1

Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 85 | 1733 | 1774 | 1796 | 1823 | 1802 |
| 90 | 2081 | 2484 | 2315 | 1893 | 1810 |
| 95 | 1700 | 1665 | | | |

ROI # 2
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 119 | | | | | 1964 |
| 120 | 1914 | 1960 | 2053 | 2417 | 3225 |
| 125 | 3660 | 2859 | 2151 | 1959 | 2027 |
| 130 | 2019 | | | | |

ROI # 3
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 179 | | | | | 2518 |
| 180 | 2192 | 2612 | 4550 | 7101 | 7062 |
| 185 | 4462 | 2831 | 2654 | 2659 | |

ROI # 4
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 362 | | | 1638 | 1623 | 1642 |
| 365 | 1649 | 1655 | 1786 | 2491 | 5184 |
| 370 | 9467 | 10123 | 6112 | 2610 | 1639 |
| 375 | 1561 | 1511 | 1466 | | |

ROI # 5
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 581 | | 817 | 854 | 844 | 844 |
| 585 | 1043 | 1990 | 5432 | 10576 | 11099 |
| 590 | 6329 | 2427 | 1028 | 794 | 807 |
| 595 | 846 | 839 | | | |

ROI # 6
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 667 | | | 760 | 751 | 710 |
| 670 | 694 | 701 | 751 | 844 | 927 |
| 675 | 967 | 821 | 686 | 704 | 635 |
| 680 | 665 | 704 | 711 | | |

ROI # 7
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 694 | | | | | 707 |
| 695 | 779 | 771 | 776 | 1078 | 2457 |
| 700 | 6922 | 14862 | 18581 | 13228 | 5175 |
| 705 | 1494 | 695 | 623 | 593 | 609 |

ROI # 8
Channel # **** Data ****

| | | | | | |
|---|---|---|---|---|---|
| 1157 | | | 427 | 418 | 417 |
| 1160 | 355 | 362 | 429 | 482 | 538 |
| 1165 | 508 | 428 | 364 | 339 | 346 |
| 1170 | 313 | 333 | 352 | | |

# REGION OF INTEREST DATA

ROI # 9

| Channel # | **** Data **** | | | | |
|---|---|---|---|---|---|
| 1209 | | | | | 387 |
| 1210 | 384 | 385 | 447 | 939 | 2858 |
| 1215 | 6755 | 10638 | 10357 | 6478 | 2450 |
| 1220 | 809 | 373 | 347 | 293 | 319 |

ROI # 10

| Channel # | **** Data **** | | | | |
|---|---|---|---|---|---|
| 1813 | | | | 250 | 244 |
| 1815 | 232 | 228 | 250 | 296 | 380 |
| 1820 | 417 | 411 | 302 | 257 | 226 |
| 1825 | 230 | 234 | 226 | 203 | |

ROI # 11

| Channel # | **** Data **** | | | | |
|---|---|---|---|---|---|
| 1917 | | | 221 | 213 | 224 |
| 1920 | 185 | 224 | 240 | 240 | 243 |
| 1925 | 235 | 282 | 286 | 258 | 255 |
| 1930 | 222 | 190 | 223 | 242 | 272 |
| 1935 | 290 | 338 | 268 | 227 | 184 |
| 1940 | 211 | 193 | 208 | 171 | 193 |
| 1945 | 204 | 184 | 190 | 186 | |

MCA #1 - Canberra S100 - 283130A.MCA - NOPI-ECP-28.3/13.0 BaSO4

Tag Number: 87
Report Group: 1/4
Group Size: 4096

Readout: Mon 08 Mar 1993 @ 09:48:42
Acquire Started: Mon 08 Mar 1993 @ 09:46:30

Elapsed Live Time: 69.00 hr.
Elapsed True Time: 69.01 hr.
Dead Time: 0.02 %

MCA Mode: PHA+
Preset Conditions: Live Time = 56.00 hr.

Calibration: 0.0000*Ch^2 + 0.4996*Ch + 1.083 keV

Area Statistics: Background Channels = 4
% Error Sigma = 1.65

Peak Statistics: Sensitivity Factor = 5.0
Expected FWHM (ch) = 2.7 - 6.0

Iso. Id. Criteria: Energy Window = +-1.000 keV
Iso. Library: C:\WINDOWS\S100\SPECTRAN.ISO

Bret Leslie
3/11/93
$\Delta t = 4140$

Integral = BACK

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) | |
|---|---|---|---|---|---|
| 1 | 43.6 | 5303 | 0 | 220.4 | |
| | 44.6 | 0.02 | 0.00 | 3.49 | |
| | | Isotope: I-135 @ 220.5 | | | Back= 10478 |
| 2 | 48.0 | 5175 | 0 | 224.9 | |
| | 49.0 | 0.02 | 0.00 | 3.49 | |
| 3 | 60.5 | 5838 | 0 | 237.4 | |
| | 61.5 | 0.02 | 0.00 | 3.49 | |
| 4 | 65.0 | 6005 | 0 | 241.9 | Back= 11843 |
| | 66.0 | 0.02 | 0.00 | 3.49 | |
| 5 | 90.5 | 7322 | 0 | 267.4 | |
| | 91.5 | 0.03 | 0.00 | 3.49 | |
| | | Isotope: Y-93 @ 266.9 | | | Back= 12635 |
| 6 | 94.5 | 5313 | 0 | 271.4 | |
| | 95.0 | 0.02 | 0.00 | 3.49 | |
| 7 | 181.9 | 6552 | 0 | 183.0 | |
| | 183.4 | 0.03 | 0.00 | 3.49 | Back=12729 |
| 8 | 187.9 | 6177 | 0 | 188.4 | |
| | 189.4 | 0.02 | 0.00 | 21458952.00 | |
| 9 | 291.4 | 3359 | 0 | 291.9 | |
| | 292.9 | 0.01 | 0.00 | 21458952.00 | Back=6645 |
| 10 | 297.4 | 3286 | 0 | 298.4 | |
| | 298.9 | 0.01 | 0.00 | 21458952.00 | |
| | | Isotope: GA-73 @ 297.4 | | | |
| 11 | 334.3 | 2915 | 0 | 334.8 | |
| | 335.8 | 0.01 | 0.00 | 21458952.00 | |
| | | Isotope: NP-239 @ 334.3 | | | Back= 5630 |
| 12 | 340.3 | 2715 | 0 | 341.3 | |
| | 341.8 | 0.01 | 0.00 | 21458952.00 | |
| | | Isotope: CS-136 @ 340.6 | | | |
| 13 | 347.8 | 3033 | 0 | 348.6 | |
| | 349.3 | 0.01 | 0.00 | 21458952.00 | Back=5553 |
| 14 | 353.8 | 2520 | 0 | 354.5 | |
| | 355.3 | 0.01 | 0.00 | 21458952.00 | |
| 15 | 579.2 | 1617 | 0 | 579.9 | |
| | 580.7 | 0.01 | 0.00 | 21458952.00 | |

# REGION OF INTEREST REPORT

| ROI # | From(keV) To (keV) | Integral CPS | Area %Error | Peak(keV) FWHM(keV) | |
|---|---|---|---|---|---|
| 16 | 585.2 | 1344 | 0 | 585.9 | Back= 2961 |
| | 586.7 | 0.01 | 0.00 | 21458952.00 | |
| 17 | 605.1 | 1603 | 0 | 605.9 | |
| | 606.6 | 0.01 | 0.00 | 21458952.00 | |
| | Isotope: | SB-125 | @ 606.7 | | Back= 2935 |
| 18 | 611.1 | 1332 | 0 | 611.6 | |
| | 612.6 | 0.01 | 0.00 | 21458952.00 | |
| 19 | 906.9 | 954 | 0 | 907.4 | |
| | 908.4 | 0.00 | 0.00 | 21458952.00 | Back= 1847 |
| 20 | 912.9 | 893 | 0 | 913.4 | |
| | 914.4 | 0.00 | 0.00 | 21458952.00 | |
| 21 | 958.9 | 1790 | 0 | 961.4 | |
| | 962.4 | 0.01 | 0.00 | 0.50 | Back= 3319 |
| 22 | 970.9 | 1529 | 0 | 971.3 | |
| | 974.4 | 0.01 | 0.00 | 21458956.00 | |
| | Isotope: | I-135 | @ 972.3 | | |

3/2/93
Bret Leslie

U-Th isotopic analysis of NOPI-ECP-28.3/13.0-WR
an aliquot has already been counted by gamma spectrometry and indicates 36,000 dpm/g. Since this sample represents the part of the ore body which was closest to the paleosurface and may contain measurable $^{232}Th$-$^{228}Ra$-$^{228}Th$ disequilibria and the spike that we normally use 17A-1A is an $^{232}U$-$^{228}Th$ spike it will require 2 isotopic measurements of Th isotopes and one for Ra isotopes. The following scheme will be used.

About 0.1 gram of NOPI-ECP-28.3/13.0-WR will be totally dissolved using method of (Zukin, 1987). The dissolved solution will then be divided into 3 separate aliquots.

BWL 3/2/93

$BaSO_4$ = 1) ~~25~~ 50 % of mass will be reserved for $BaSO_4$ precipitation and will use $^{133}Ba$ as yield tracer. This will allow $^{228}Ra$ to be measured (~.3 dpm) from either yield calculation or the $^{228}Ra/^{226}Ra$ ratio and whole rock powder $^{226}Ra$ measurement.

U-Th = 2) 25% of mass will be spiked with 17A-1A and will be measured for $^{238,234,232}U$, $^{232,230}Th$

BWL 3/3/93

Th = 3) ~~45~~ 475 % of mass will be unspiked and Th separated and counted for $^{232,230,228}Th$. The $^{230}Th$ will be yield tracer and will require data obtained from split #2.
⇒ $^{232}Th$ ≃ .3 cpm

Mass of 28.3/13.0 0.1037 grams

Added 100 ml 8N HCl taken down to 40 ml
Lot# 905802

Content transfered to centrifuge and supernate put into clean 250 ml teflon beaker

3/2/93
BWL

The residue is washed with DIW & 8N HCl back into original beaker. 50 ml HF & 2.5 ml $HClO_4$ are added. Lot # 904984 & 913360. and evaporated to dryness

This procedure (50 ml HF + 2.5 ml $HClO_4$) was repeated and the sample taken to dryness

3/3/93
BWL

60 ml of aqua regia was added to dried residue (3:1 HCl:$HNO_3$) Lot # FL-02-0786 & FL-04-0390

The solution is evaporated down to ~25 ml

This solution combined with supernate from the 8N HCl solution step and contents are evaporated to less than 25 ml.
At this juncture I need to know the mass of the solution so that appropriate aliquots can be taken, by mass for each analysis.

Weight of centrifuge tube empty: 13.5058
Weight of tube & total solution: 49.5940
Total solution weight = 36.0882

Weight of tube & solution after $BaSO_4$ aliquot removed 31.8227

Weight of tube & solution after Th isotopes aliquot is removed 15.0219

| | | |
|---|---|---|
| wt of $BaSO_4$ solution | = 17.7713 g | % Total = 49.244 |
| wt of Th isotope solution | = 16.8008 g | % Total = 46.55 |
| wt of U-Th isotopes solution | 1.516 g | % Total = 4.201 |

wt Total solid = .1037
Equivalent solid wt $BaSO_4$ = 0.0511 grams
Th = 0.0483
U-Th isotopes = 0.0043565 g

3/3/93 BWL

The U-Th fraction was transfered back into the teflon beaker quantitatively with 0.1 N $HNO_3$ & Nanopure $H_2O$. It was covered with watchglass.
The $BaSO_4$ aliquot is in a 150 ml glass beaker and it was diluted to 50 ml with nanopure $H_2O$ and covered with watch glass.

Fe carrier (031/56) (1 ml) was added to Th aliquot in centrifuge tube, the pH brought up to neutral with concentrated $NH_4OH$ (Lot # FL-04090).

The tube was centrifuged, decanted, washed with $H_2O$ and agitated. This was repeated again & finally centrifuged.

The $BaSO_4$ will be precipitated following procedures outlined on pg 64-65 & 70 of this book on 3/4/93.

U-Th fraction will need to be spiked and Fe carrier added.

3/4/93 BWL

all NOPI-ECP-17-SEP U&Th solutions taken to dryness a column for NOPI-ECP-28.3/13.0 Th sample is prepared and the procedures for radiochemical analysis of U-233 (031/177) is followed. Progress is detailed on sheets contained alpha spectrometry Peña Blanca Binder.

2820

Spike 17A-1A is approximately 8.38 dpm/g $^{228}Th$ and 22.57 dpm/g on 3/3/93. Since I want to have $^{228}Th$ to be close to $^{230}Th$ activity I need to spike such that $^{228}Th$ activity added is about 157 dpm. BWL 3/4/93. So we need to add about 18 grams of 17A-1A if $^{228}Th \approx {}^{230}Th$, however this would be a factor of 3X too high for $^{231}U$ versus $^{234}U$. Thus we will add about 6 grams of spike to the split to be used for U-Th isotopic analysis.

3/4/93 BWL The $BaSO_4$ fraction is filtered using 0.45um filter Metricel. The process isn't necessarily quantitative since we are trying to measure $^{228}Ra/^{226}Ra$ ratio primarily. The filtered material is washed into 50 ml centrifuge tube and centrifuged down. Using a pasteur pipet the contents of the tube are put into a gamma vial. This centrifuging and transfering process continued until all $BaSO_4$ is contained in gamma vial. The procedures on pages 63-64 were followed.

NOP1-ECP-283/13.0 - U-Th isotopes fractions

Mass of Spike 17A-1A = 6.2016 grams
25mg Fe clean carrier added
Solution will be allowed to equilibrate overnight and gently heated for 1-3 hours before precipitation and separation started.

3/5/93 Separation is documented on sheet record and stored in alpha spectrometry binder Peña Blanca.