THE ROLE OF SAND/SHALE INTERFACES IN NAPL TRANSPORT

by

T. M. Whitworth
New Mexico Bureau of Mines and Mineral Resources
New Mexico Institute of Mining and Technology

Claire Hsu
Department of Earth and Environmental Sciences
New Mexico Institute of Mining and Technology

New Mexico Bureau of Mines and Mineral Resources
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ABSTRACT

Spilled nonaqueous phase liquids (NAPLs) can be trapped by relatively small-scale structures at sand/shale interfaces just as hydrocarbons are naturally trapped in larger scale structures in oil and gas fields. We measured micro-scale closure at the upper sand/shale interface at three sites for fluvial/alluvial and tidal flat depositional environments and found that closure volume ranged from a low of 5.55 l/M^2 to a high of 28.8 l/M^2. The average for all sites was 12.2 l/M^2. The area of each site ranged between 929 and 2090 cm^2. We could not measure closure height for individual features, so we measured the topographic variation at each site. Topographic variation ranged up to a maximum of 3.3 cm, and site means ranged between 1.3 and 2.4 cm. We also conducted sand box experiments to see if these micro-scale features have NAPL trapping potential. Our results suggest that for NAPL to be trapped at greater than residual saturation, the closure height must be greater than the capillary rise of water into the NAPL. A closure height of 4.0 cm effectively trapped Marvel Mystery Oil™ when the average grain size was 1.5 mm, but failed to do so at smaller grain-sizes. Our experimental results are approximately reproduced by Hobson's Formula which states that the height of capillary rise is inversely proportional to grain-size and is also a function of the physical properties of the NAPL. Further calculations using Hobson's Formula suggest that traps containing coarse-grained material are effective for some NAPLs at closure heights of one cm, while traps containing fine-grained material require closure heights of slightly less than one meter to five meters or more. It is well known that clays have membrane properties. Therefore, we also conducted an experiment to see if passing gasoline through clay results in separation or fractionation of the compounds comprising gasoline. The results were negative.

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INTRODUCTION

Just as oil and gas are trapped by larger structures, non-aqueous phase liquids (NAPLs) can be trapped by smaller structures at sand/shale interfaces. Many groundwater problems in the United States involve NAPL contamination (Feenstra and Coburn, 1986; Mercer and Cohen, 1990; Cohen and Mercer, 1993). It is well known that dense non aqueous phase liquids (DNAPLs) can accumulate in low spots on the aquifer floor (Fetter, 1993; Cohen and Mercer, 1993). It is less commonly recognized that light nonaqueous phase liquids (LNAPLs) such as gasoline or jet fuel may collect in topographic highs at sand/shale interfaces, especially if they are released below the water table or if the water table fluctuates (Whitworth, 1994; Vroblesky *et al.*, 1995).

The purpose of this study is to begin to investigate the potential role of smaller-scale NAPL trapping structures at sand/shale interfaces. A complete investigation of this topic is not within the scope of this paper. However, we will present some guidelines based upon sand box visualization experiments, field measurements, and calculations with Hobson's Formula which we hope will provide a starting point for the study of environmental-scale sand/shale interface NAPL traps.

Saturated zone NAPL flow is dependent upon the densities, viscosities, and interfacial tensions of the liquids. NAPLs are also subject to dispersion, diffusion, adsorption, and microbiological degradation (Fetter, 1993). In short, the behavior of NAPLs in the subsurface is complex. Pinder and Abriola (1986) needed 27 independent equations to develop a comprehensive model for NAPL flow. Common LNAPLs include gasoline, jet, and diesel fuel. DNAPLs are commonly chlorinated hydrocarbons and include trichloroethylene and pentachloropenol.

Aquifers are naturally water wet because they contained water before any spilled NAPL entered the aquifer (Fetter, 1993). When water, or any other liquid, is in contact with a surface, it has an interfacial energy. Interfacial energy is the result of a difference between the attraction of liquid molecules for one another and the attraction between the surface and the molecules of the liquid. This difference in attraction is called interfacial tension. It is defined as the amount of work necessary to separate one unit area of the liquid from the surface. Liquid to liquid boundaries, such as that between water and immiscible liquids also possess interfacial tension (Fetter, 1993).

If two immiscible liquids are in contact, a curved surface develops at the interface. When the pore pressure inside each liquid is measured, it is found that the pore pressures are not the same (Fetter, 1993). This difference in pressure is the capillary pressure. Capillary pressure also develops between water and the aquifer matrix. Capillary pressure is directly proportional to interfacial tension and inversely proportional to the radius of curvature at the contact between the two liquids. This suggests that capillary pressure is a function of not only the properties of the two immiscible liquids present, but also of the amounts of each liquid present (Fetter, 1993). Capillary pressure is also a function of the pore and pore throat geometry. For these reasons, exact capillary pressures distributions vary and are difficult to calculate. They can be determined in the laboratory for specific conditions (Fetter, 1993). Exact determination of capillary pressure conditions for specific compounds is not within the scope of this research. Rather, it is our goal to relate the general principles of NAPL hydrology to sand/shale interface NAPL trapping.

Water is attracted to mineral surfaces by interfacial tension. Therefore, some of this water is stuck rather tightly to the grains; making them water wet. This tightly bound water does not flow through the pores and is called irreducible water. The irreducible water saturation is the water content at which no additional water will flow (Fetter, 1993).

When a NAPL encounters saturated (water-wet) porous media, it must overcome the capillary pressure between the water and the NAPL in order to enter the pores. This capillary or saturation pressure is related to the size of the pore throats that the NAPL must pass through as well as the physical properties of the compound. The capillary pressure required for NAPL to enter very small pores can be quite high, often on the order of tens of atmospheres while the capillary pressure required for NAPL to move through the pores between coarse-grained material can be just tenths of atmospheres or less (Dahlberg, 1995). Thus NAPL can move relatively freely through sands but will not freely enter shales and can be trapped at sand/shale interfaces when sufficient closure exists.

Capillary entry pressures changes due to grain size changes can be important even in the body of the aquifer, resulting in capillary trapping (Fetter, 1993). However, this study focuses on the role of geometry at sand/shale interfaces in the trapping of NAPLs.

Most NAPL spills occur at the surface, or from underground storage tanks. In the vadose zone, both LNAPLs and DNAPLs tend to follows the paths of greatest permeability (Fetter, 1993) and tend to collect on top of finer-grained materials. When closure exists on top of these fine grained materials, NAPLs become trapped or pooled within the vadose zone. However, NAPL trapping in the vadose zone is not the topic of this paper.

Once in the saturated zone, LNAPLs tend to float on the water table while DNAPLs sink toward the base of the aquifer. Even though LNAPLs float, they can still migrate into shallow confined aquifers. Whitworth (1994) presented the following pathways for LNAPL to reach shallow confined aquifers:

1. If construction, such as tank installation, breaches an overlying clay or shale layer.
2. Through cracks or fractures in the clay or shale.
3. Through biologic structures such as root traces, etc. Palmer (1992) states these may be open to tens or hundreds of feet.
4. Through earthquake-produced sand blows. During an earthquake, liquefied sand bursts through the overlying clay layer and, in many cases, leaves a fully penetrating sand-filled conduit through the overlying clay layer.

Due to their greater density, DNAPLs, depending upon spill volume, can easily migrate to significant depths. Large DNAPL releases do occur. For example, sites at Love Canal and Hyde Park each contained many thousands of tons of buried DNAPLs including chlorinated benzenes, chlorotoluenes, carbon tetrachloride, tetrachloroethene, and trichloroethene (Cohen and Mercer, 1993).

METHODS

Field Work

We carefully excavated a number of sand/shale interfaces for study. The locations and geological descriptions of these sites are given in Appendix A. After considerable effort expended toward constructing digital elevation models of the surfaces from which we attempted to map closure, we found that it was simpler to pour plaster molds of the surfaces. We built square wooden frames which we sealed to the excavated

outcrop with natural clay caulking, and then filled with plaster. Our data were derived from these plaster molds.

We measured closure volume of each plaster cast in the laboratory using a mass balance technique. We first sealed the plaster casts with varnish because plaster tends to absorb water. Then we placed each plaster cast on a large funnel frame. This funnel frame was designed to funnel water poured over the plaster cast into a pre-weighed beaker. The mass balance measuring procedure is as follows:

1) Place the plaster cast on the funnel frame.
2) Pour deionized water into a pre-weighed beaker and record the weight of water.
3) Pour water over the plaster cast until it fills all of the low spots and runs over onto the filter frame and into another pre-weighed beaker.
4) Weigh the water remaining in the beaker.
5) Carefully dab up all remaining drops of water on the sides of the plaster cast frame and the funnel frame with preweighed lab-wipes and record the damp weight.
6) From the recorded numbers the volume of water remaining in the low spots on the plaster cast can be calculated.

All of our plaster casts were taken on upper sand surfaces. Therefore, when the plaster casts were inverted for measurement, the hollows represented potential LNAPL traps. We did not investigate the upper surface of a shale below a sandstone, but visual examination suggests that the topographic variation at the lower interfaces is similar for our study area.

Four mass balance measurements were performed on each plaster cast. The results of the first measurement were discarded because we found that there was some

water absorption in this first wetting. Our mass balance measurement single standard deviation precision for the following three measurements averaged ±1.4 percent.

We were also interested in the topographic variability of the surfaces. Therefore, we built a frame that fit over the plaster casts and measured the height of the surface at 16 points for each plaster cast. This data was then normalized to the lowest elevation reading on each plaster cast so that the reported numbers can be interpreted as actual topographic variation. We used a digital depth gage accurate to 0.01 mm to take the measurements.

Sand Box Experiments

A sand box was constructed from a solid piece of 1.90 cm thick aluminum plate. The opening was milled out and included a 4 by 8 cm trap along the upper surface of the cutout. O-rings were set 0.16 cm from the edge of the opening (Figure 1). A fluid input port, a fluid output port, and a fill port in the top of the trap were drilled and tapped 1/8" NPT.

The sand box was assembled by clamping 0.64 cm thick glass plates to the sides of the sand box with small c-clamps. The o-rings provide the seal between the glass plates and the aluminum sand box frame. Fine screens were placed into the inlet and outlet ports to keep the glass beads from piping out of the sand box during the experiments, and the tubing fittings were then screwed into place in these outlets. The sand box was then filled by pouring the proper size glass beads into the fill port with periodic firm shaking to settle and compact the beads. Next a 1/8" NPT plug was lightly screwed into the fill port.

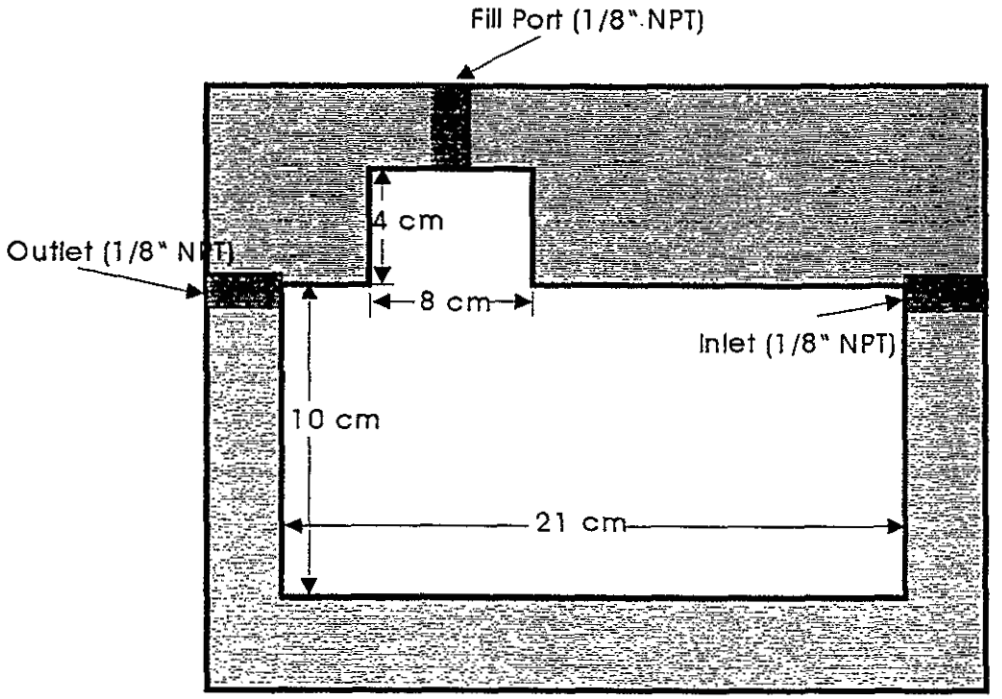

Figure 1. Schematic of sand box used in visualization experiments.

A Masterflex™ tubing pump was then connected to the inlet port and the outlet port was connected to a waste container. The sand box was then slowly saturated with water. The plug in the top fill port was tightly screwed into place as soon as water began flowing out of the top port. Otherwise air bubbles would accumulate in the trap and it would be difficult to saturate this portion of the sand box.

After the sand box was saturated with water, Marvel Mystery oil was valved through the tubing pump and the water in the sand box was slowly displaced by the oil. This water displacement process assured that the beads would be water-wet as are most of the sediments at NAPL contaminated sites. Next, water was again pumped through the oil-saturated sand box, much like what would occur as a natural NAPL plume migrates

along a sand/shale interface. Photographs were taken during the process to record the results. Several experiments were run with differing bead sizes.

Clay Membrane Experiment

The experimental hyperfiltration cell consists of an aluminum cylinder with an internal diameter of 5.02 cm, and a wall thickness of 0.64 cm, which is fitted to two o-ringed, 2.5 cm thick, aluminum™ caps. The caps are held in place by four threaded rods which pass through both caps parallel to the cylinder (Figure 2).

Smectite was chosen to construct the membrane because most of the experimental work to date has been conducted with smectite (Kharaka and Berry 1973; Benzel and Graf 1984; Kharaka and Smalley 1976; Haydon and Graf 1986; Demir 1988; Coplen and Hanshaw 1973; McKelvey and Milne 1963; Fritz *et al.* 1987; Fritz and Eady 1985 and; Fritz and Marine 1983), and because smectite has significant double-layer properties. A commercial bentonite was used to prepare the smectite membranes. This upper Cretaceous clay was mined in Crook county, near Colony, Wyoming. X-ray analysis shows the clay used in these experiments to be an almost pure Na-smectite containing only a trace of quartz. The clay used to construct the membranes was beneficiated to achieve an average 30mm size by means of an air separator (Whitworth et. al. 1993). Following separation, the fine fraction was slurried with one molar NaCl solution, dialyzed to remove excess solute, and finally freeze-dried. To form the membranes, 2.07 grams of freeze-dried clay was slurried in approximately 200 ml of deionized water. This slurry was then placed in the experimental cell and connected to the syringe pump which was filled with deionized water. The syringe pump was then used to force the clay slurry through the experimental cell sedimenting the clay onto the filter paper at the base of the

cell as a clay membrane. After the membrane was formed and compacted, deionized water was pumped through the clay membrane so that the filtration coefficient L_P could be measured. Following measurement of L_P, the deionized water was poured from the cell and replaced with the 205 ml of unleaded gasoline.

During the experiment, the cylinder containing the clay membrane was inverted so that the gasoline would be in contact with the clay. The gasoline was forced through the clay using a deionized water drive from the syringe pump. Samples were collected

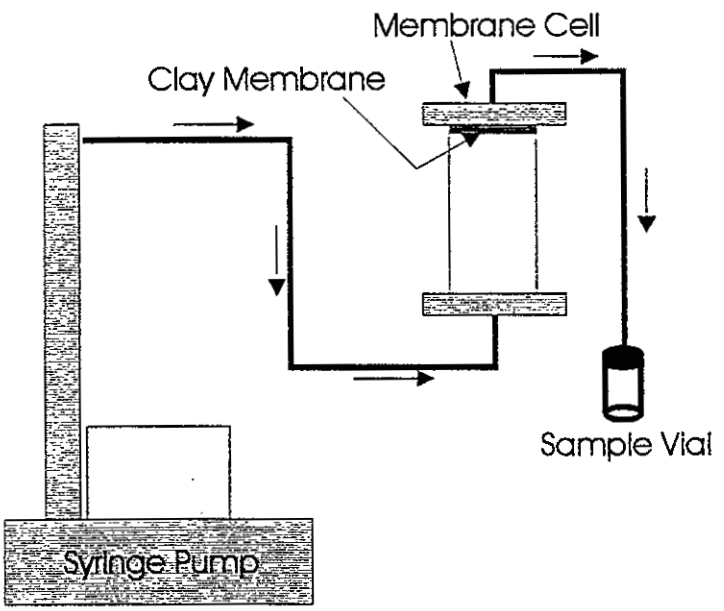

Figure 2. Experimental setup for clay membrane and gasoline experiment.

periodically for analysis during the experiment through an attached syringe needle directly into in Teflon-sealed glass vials. The samples were then refrigerated and shipped to the HOWE laboratory in Hobbs, New Mexico for analysis by Dr. Doug Strong.

RESULTS

Field Work

We found that closure volume ranged from a low of 5.55 l/M^2 to a high of 28.8 l/M^2 at the sand/shale interfaces we measured. The average for all sites was 12.2 l/M^2. If we assume an average porosity of 30 percent, this translates to maximum potential trapping capacities ranging from 1.67 to 8.6 l/M^2 with an average value of 3.65 l/M^2.

We used three different sized frames at site 1 in order to see if the measured closure volume exhibited some scaling trend (Table 1). There was no general increase of closure volume with frame size. Therefore, we suspect that our chosen frame size of 1024 cm^2 provides reasonably accurate results. However, the closure volumes reported here should be interpreted as minimum values due to edge effects. Our detailed data and statistical analyses of closure volume measurements are presented in Appendix B.

Perhaps the most important aspect of interface trapping is the closure height. We could not measure the actual closure height for individual traps. However, the maximum closure height at an interface cannot be greater than the maximum relief at that interface. Therefore, we looked at topographic variation as an indicator of maximum closure height.

Table 1. Closure volumes versus frame size at Site 1.

Frame Size (cm^2)	Average Closure Volume (l/M^2)
1024	11.17
1452	12.02
2090	11.49

At site 1, the maximum topographic variation was 2.4 cm, and the mean was 1.3 cm. At site 2, the maximum was 3.3 cm and the mean was 2.0 cm. At site 3, the maximum was 4.842 cm and the mean was 2.4 cm. Our measurements were at the

micro-scale. Greater topographic variation exists at larger scales on sand/shale interfaces, especially in intermontane valleys (Love et al., 1997). However, we did not attempt to examine larger scales in this study. Data from our topographic measurements are presented in Appendix C.

Sand Box Experiments

The sand box visualization experiments were designed to determine if small-scale trapping features at sand/shale interfaces are important. We ran four sand box visualization experiments.

The first run used 1.5 mm glass beads as a porous medium. This bead size is equivalent to very coarse sand. We first saturated the sand box with water (Figure 3A). After the sand box was saturated with water, we input Marvel Mystery Oil™ which has a bright red color and therefore gave good contrast in the photographs. Notice in Figure 3B that the oil has just begun to flow into the beads through the input port on the right side of the photograph. Flow is from right to left in each photograph. We pumped the oil into the sand box until it was essentially saturated with oil. Figure 3C shows the water in the sand box being displaced by oil. Figure 3D shows the sand box almost completely saturated with oil. After the oil filled the sand box we again input water which began to displace the oil. Figure 3E shows the sand box after about half the oil has been displaced by water. Figure 3F shows the sand box at the end of the experiment (2 hours and 20 minutes) where steady state had been reached and no more oil flowed from the sand box. Notice that the 4 by 8 cm trap is almost completely saturated with oil at this point and that the rest of the sand box is at residual saturation. The base of the oil in the trap was

slightly tilted toward the exit port due to the advective force of flowing water (For more information on this phenomenon see Fetter, 1993 or Dahlberg, 1995). The flow rate through the sand box during this experiment was 55.5 cm^3/min.

The second run used 0.5 mm glass beads. This size bead lies on the boundary between medium and coarse sand. The procedures were identical to the first experiment. The flow rate for this experiment was 40.5 cm^3/min. Figure 4A shows the sand box initially saturated with water and Figure 4B shows the oil beginning to displace the water. This continued (Figure 4C) until the sand box was saturated with oil (Figure 4D). At this point, we began pumping water into the sand box to displace the oil. Figure 4E shows the sand box after much of the oil had been displaced. Notice that the oil in the trap was already being displaced. By the end of the experiment at 1 hr and 20 minutes, the sand box and the trap remained at residual saturation (Figure 4F).

Both the third and forth experiments used 0.2 mm beads, This grain-size is equivalent to fine-grained sand. Otherwise the procedures were identical to the first two experiments except that neither of these experiments ran to completion.
In the third experiment, the screen in the outlet port was too coarse and let too many glass beads through during the experiment resulting in noticeable settling within the sand box. The photograph in Figure 5A was taken soon after the oil began to be displaced by water.

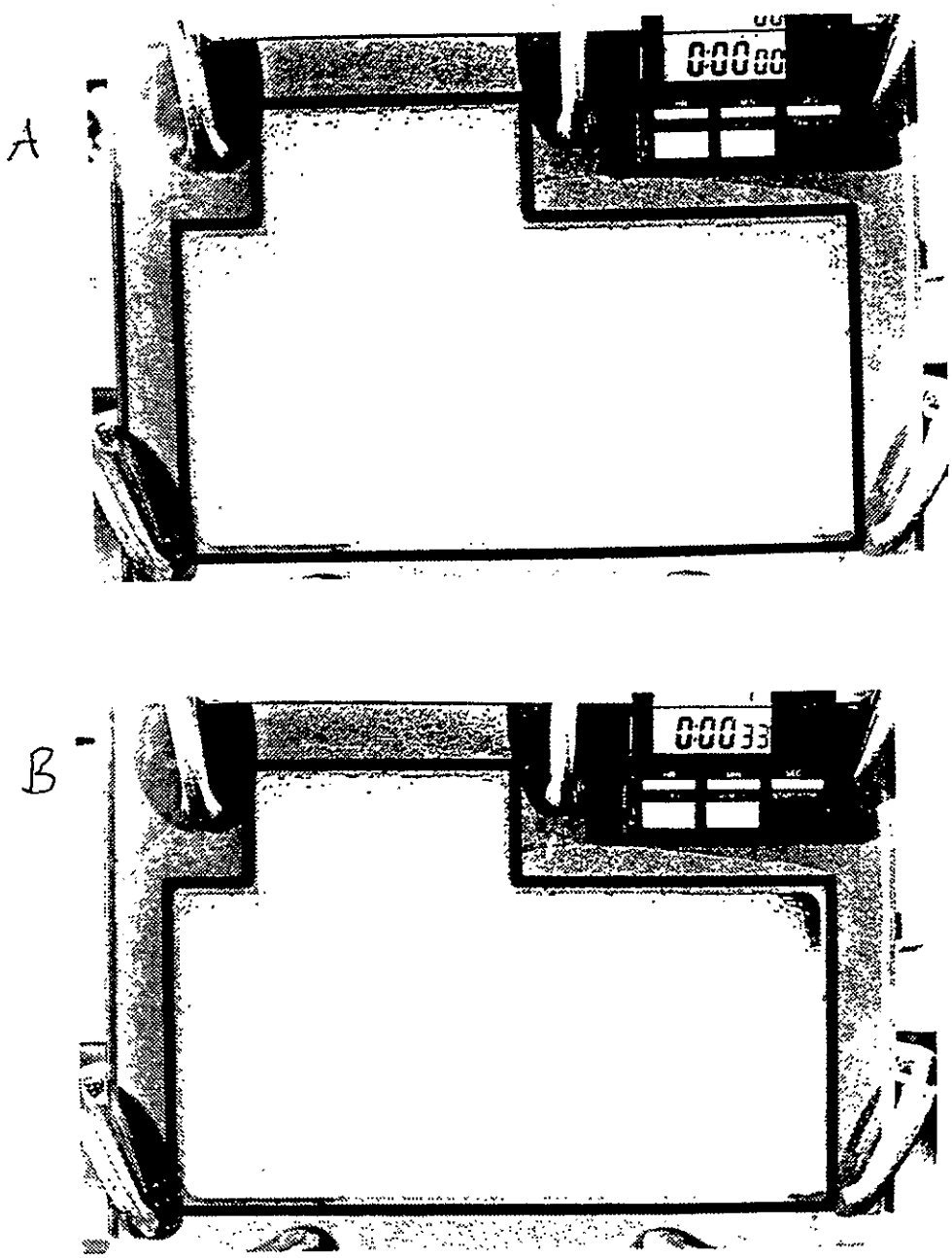

Figure 3. Results of sand box visualization experiment 1. This experiment used 1.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photo shows the sand box after initial saturation with water (A). The bottom photo was taken as the oil began to flow into the sand box (B). Note the darker color of the oil at the middle right hand side of the photo as it enters the beads through the inlet port.

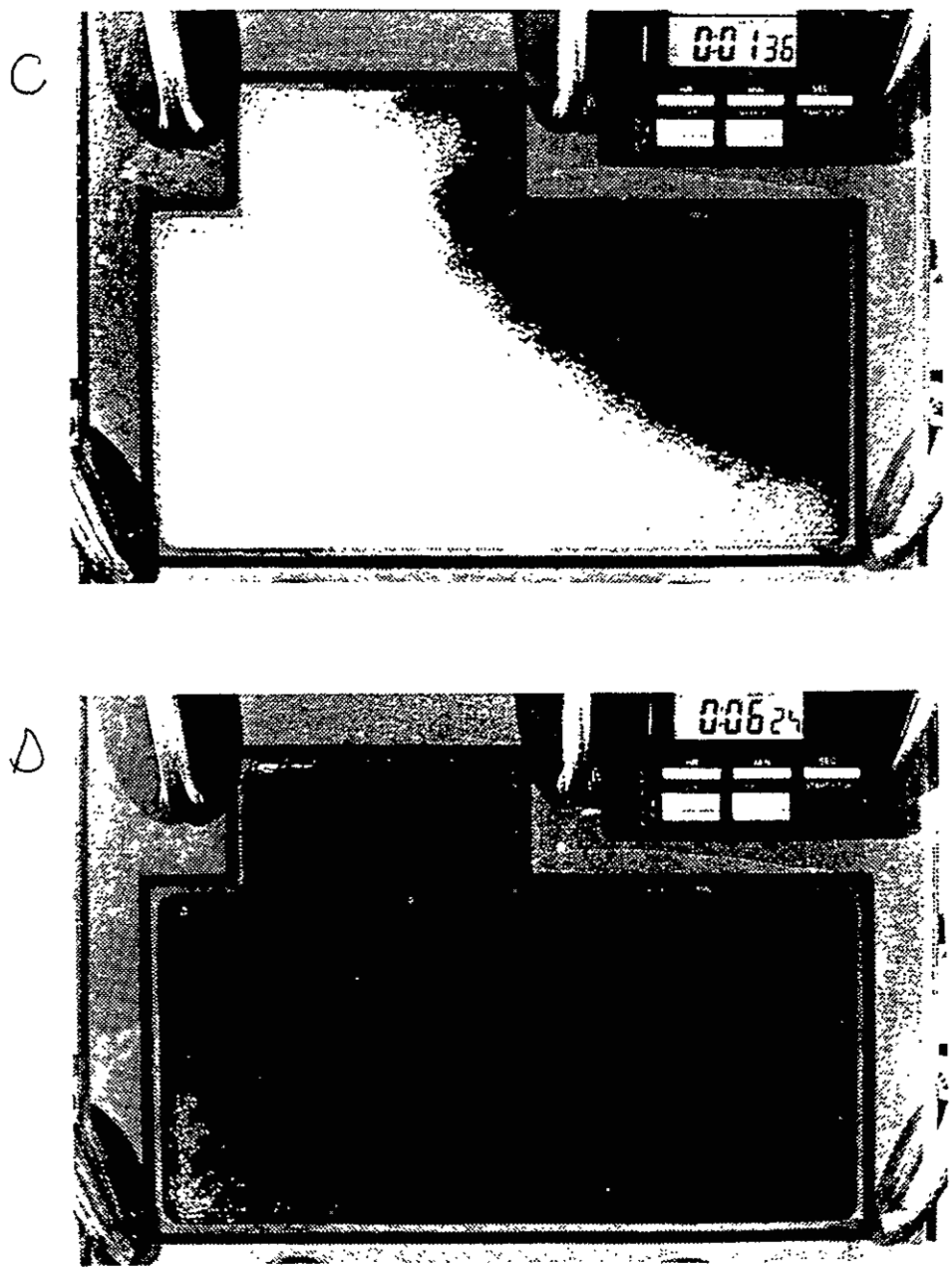

Figure 3 continued. Results of sand box visualization experiment 1. This experiment used 1.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph shows the oil front invading the sand box from right to left (C). The bottom photograph shows the sand box almost completely saturated with oil (D).

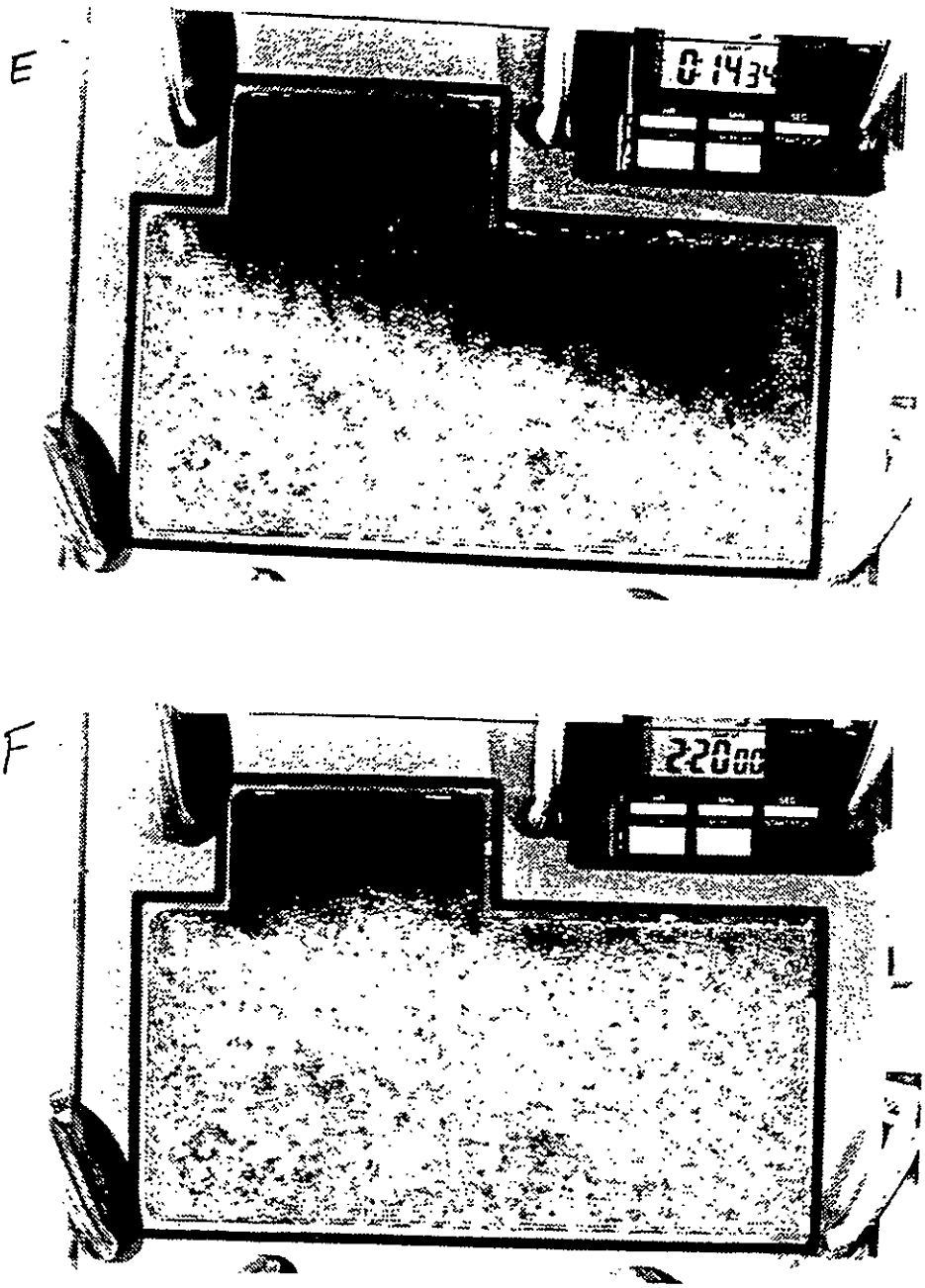

Figure 3 continued. Results of sand box visualization experiment 1. This experiment used 1.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph shows the oil being displaced by a water flood (E). The bottom photograph was taken after 2 hours and 20 minutes when oil had ceased to flow from the sand box (F). Note that the trap is still full of oil.

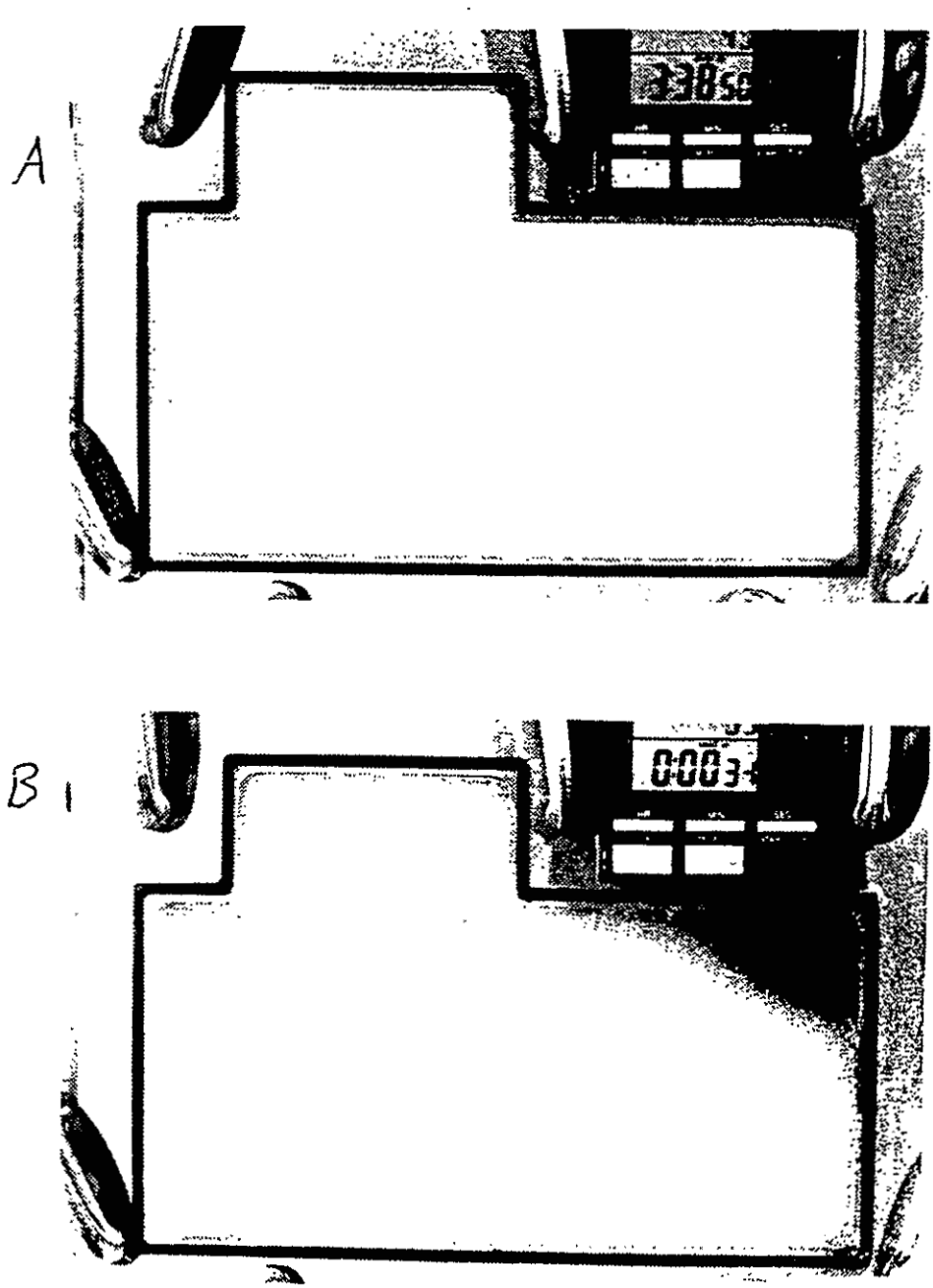

Figure 4. Results of sand box visualization experiment 2. This experiment used 0.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photo shows the sand box after initial saturation with water (A). The bottom photo was taken as the oil began to flow into the sand box (B). Note the darker color of the oil at the middle right hand side of the photo as it enters the beads through the inlet port.

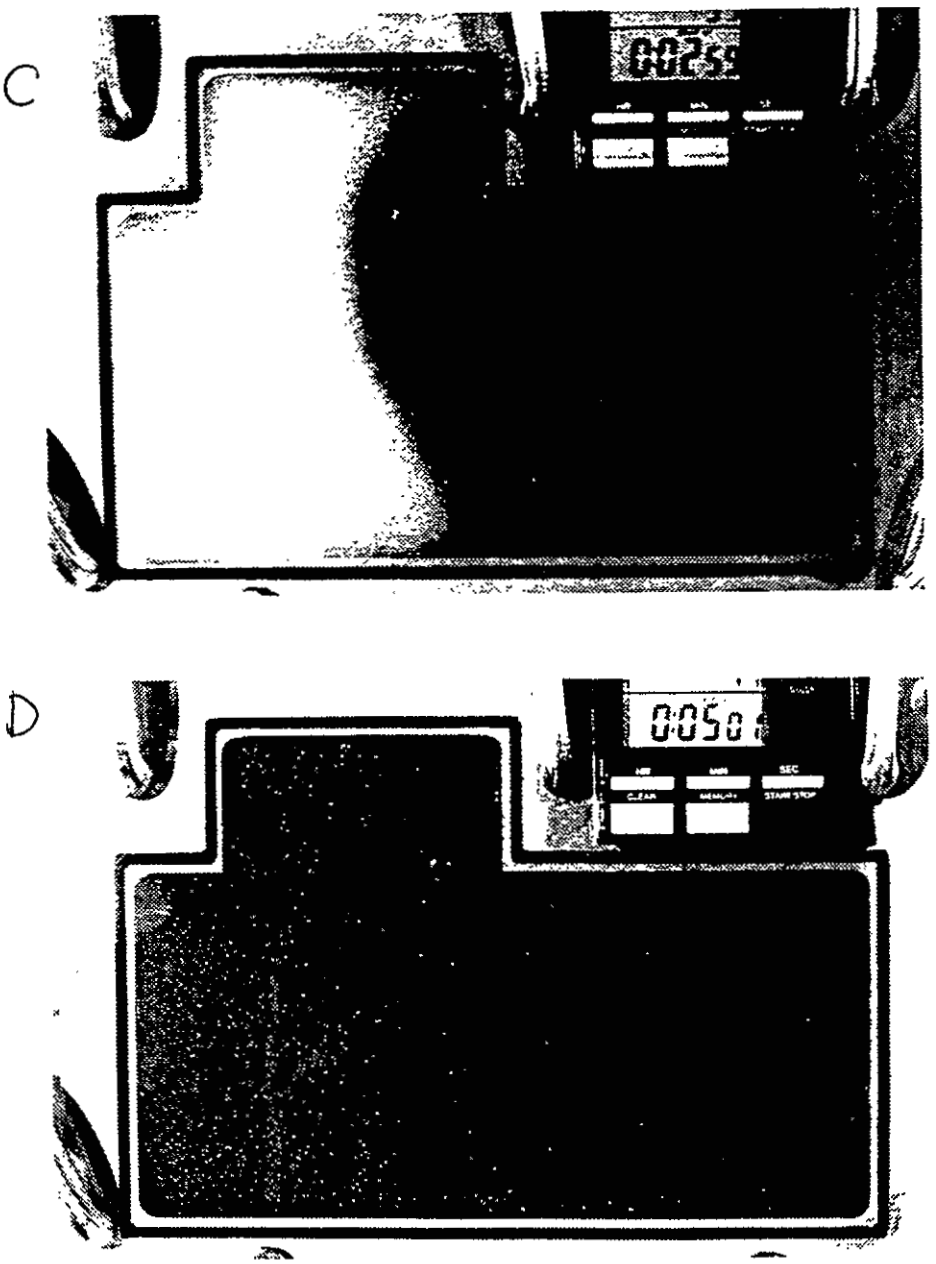

Figure 4 continued. Results of sand box visualization experiment 2. This experiment used 0.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph shows the oil front invading the sand box from right to left (C). The bottom photograph shows the sand box almost completely saturated with oil (D).

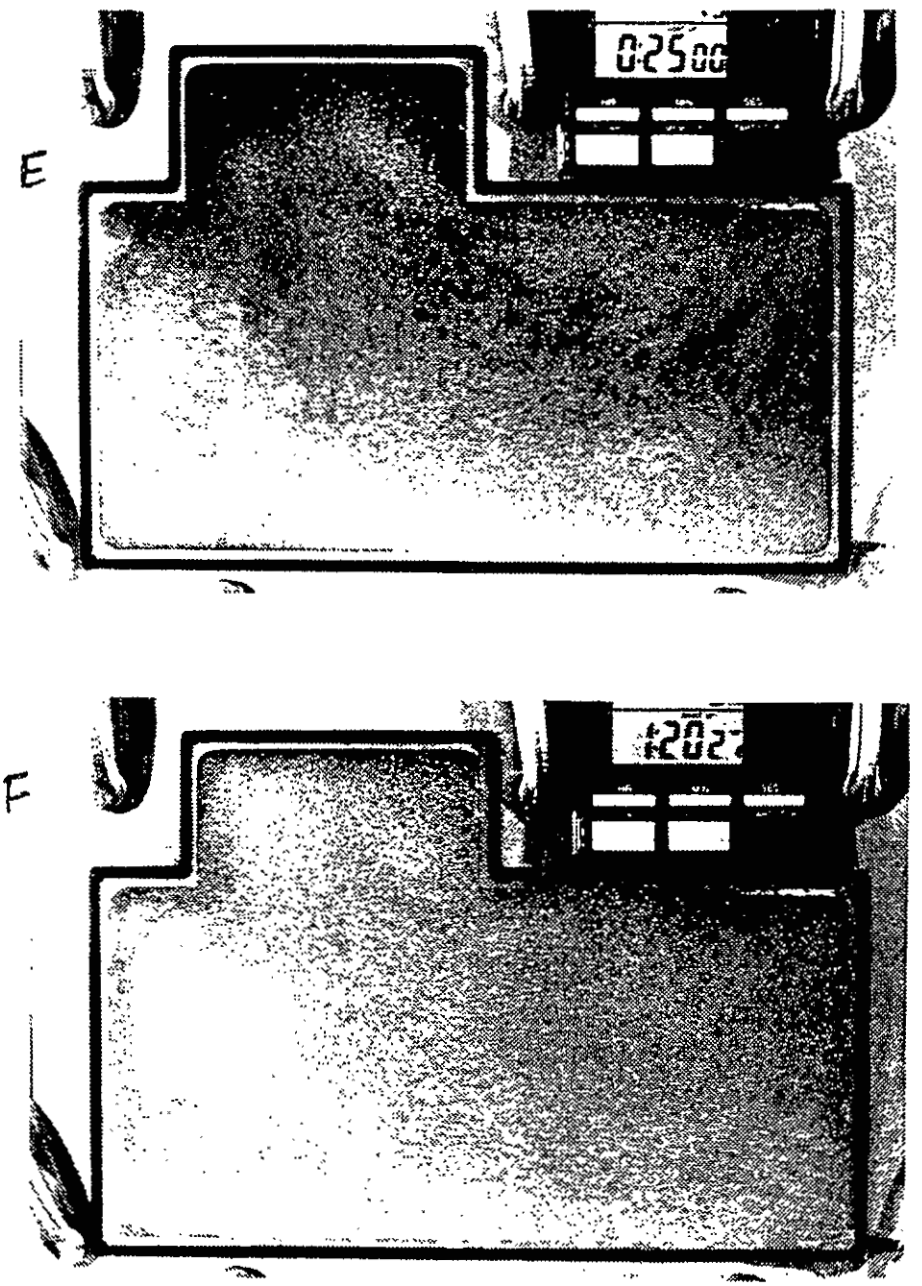

Figure 4 continued. Results of sand box visualization experiment 2. This experiment used 0.5 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph shows the oil being displaced by a water flood (E). The bottom photograph was taken after one hour and 20 minutes (F). Note that the trap is holds oil only at residual saturation and the pores are not saturated with oil.

Notice that the beads have settled significantly along the upper surface adjacent to the input port on the right side of the photograph. The settling resulted in the water flux bypassing the less permeable glass beads below the settled zone. As a result, the oil was not displaced from the area below the settled zone. Notice however, that the trap began to empty of oil quite early in the experiment and by the end it remained at residual saturation (Figure 5B). Notice that further settling of the glass beads occurred at the top of the trap.

The fourth experiment was terminated early for two reasons. First, we still had some bead loss and settling even though the screens were replaced with coarse filter paper. We suspect that a perfect seal was not obtained with the filter paper. Second, the glass cracked before the end of the experiment. Even though this experiment did not run to completion, the results are interesting. The photograph in Figure 6A was taken after the oil began to be displaced by water. Notice that again there was some settling. Not only did the glass beads settle adjacent to the input port, but a void developed in the upper right hand portion of the trap. This void was about ½ cm long and ¼ cm high. It was beginning to fill with oil even though the grains around it were being flushed. By the end of the experiment (Figure 6B) this void was saturated with oil even though the fine-grained beads around it remained at residual saturation. The flow rate during the third experiment was 55.5 cm^3/min. the flow Rate during the forth experiment was 31.5 cm^3/min.

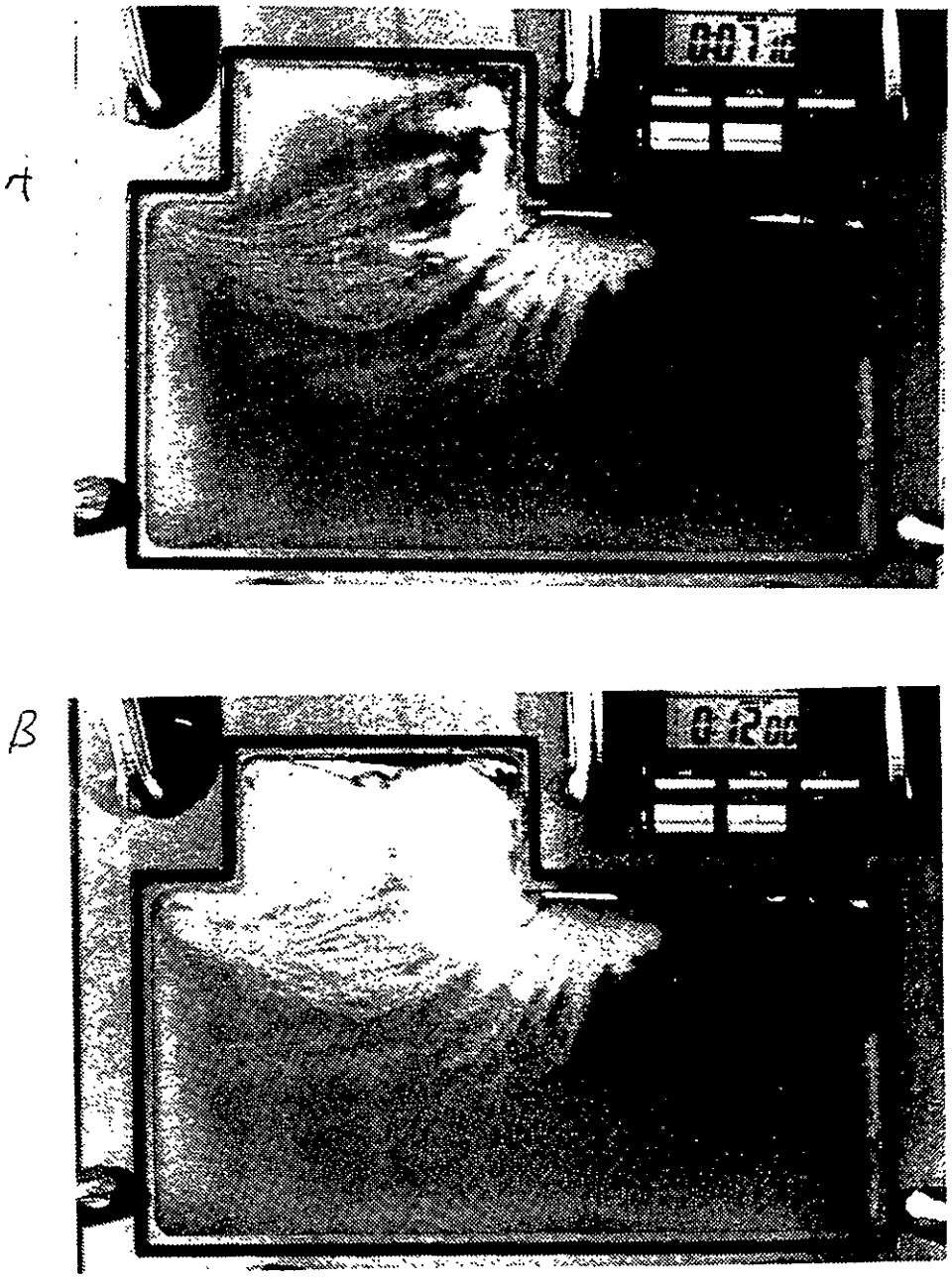

Figure 5. Results of sand box visualization experiment 3. This experiment used 0.2 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph was taken after the sand box was saturated with oil and water flood was initiated (A). Notice that the trap is already beginning to empty. The bottom photograph was taken at only 12 minutes into the run (B) Notice that the trap is already at residual saturation.

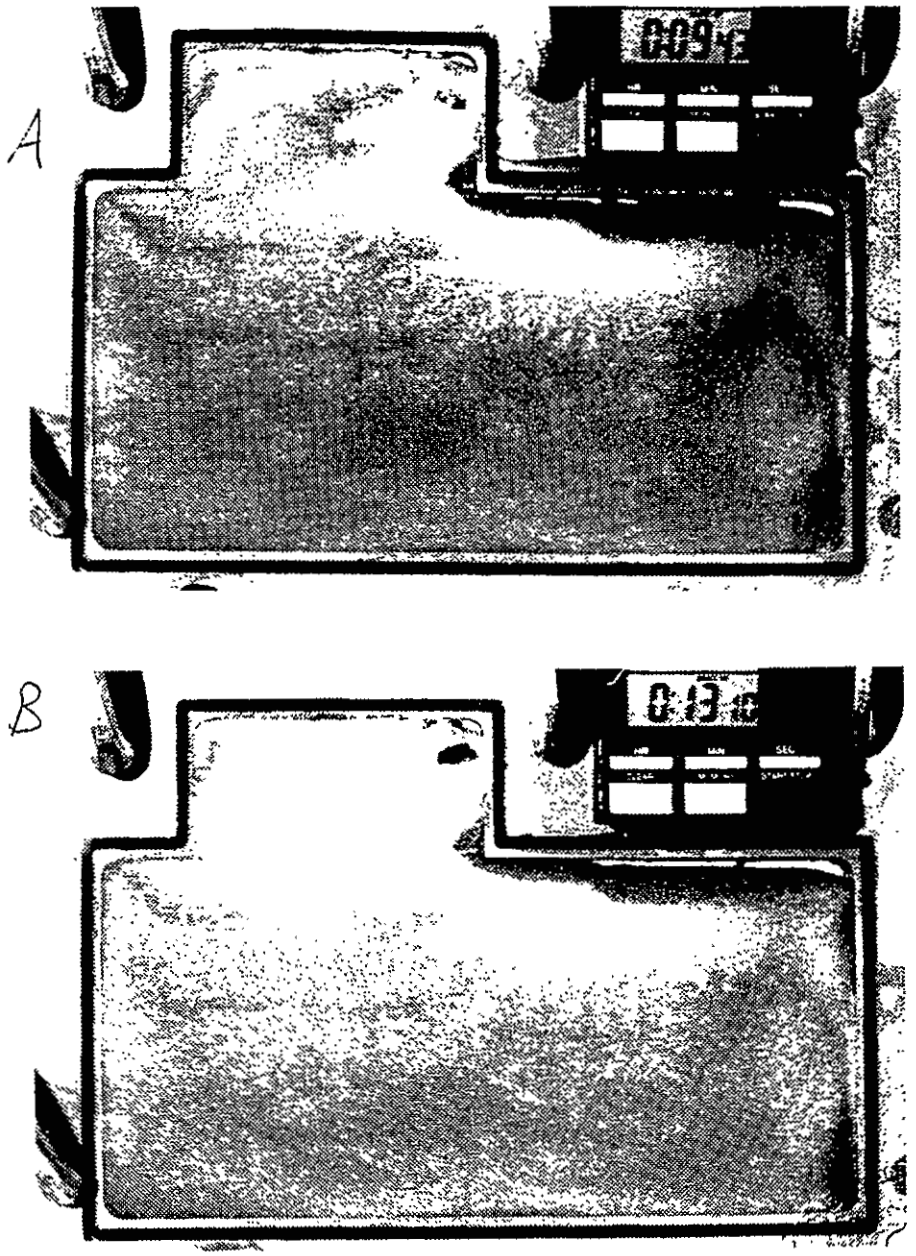

Figure 6. Results of sand box visualization experiment 4. This experiment used 0.2 mm diameter glass beads as a porous medium, tap water as the wetting fluid, and Marvel Mystery Oil™ as the LNAPL. The top photograph was taken after the sand box was saturated with oil and water flood was initiated (A). Notice that the trap is already beginning to empty. The bottom photograph was taken at only 13 minutes into the run (B) Notice that the trap is already at residual saturation. The interesting thing to note is the settling cavity that formed in the upper right hand part of the trap. Notice that is it now contains trapped NAPL. Similar capillary trapping could occur within interface traps if coarse-grained zones are present.

Clay Membrane Experiment

The results of this experiment were negative. There was no apparent fractionation of the organic compounds during passage through the clay. The results of chemical analyses are presented in Appendix D.

DISSCUSSION

Our study of the micro-scale topographic variation and measurement of closure volume at sand shale interfaces is the first of its kind. It is a beginning and the results should not be interpreted as definitive. Our purpose is to point out that such studies can and should be done, and to begin to investigate which topographic scales are important to study. The sand box visualization experiments were done to illustrate the role of capillary pressure in NAPL trapping at sand/shale interfaces.

When a NAPL body is in contact with water in a porous media, a capillary fringe or zone of capillarity exists between them (Levorsen, 1967). Water will rise in the zone of capillarity until it can no longer displace NAPL. This happens when the interfacial forces are balanced. The height of capillary rise for a given pore and pore throat size can be calculated from Hobson's Formula (Fetter, 1993).

$$h_c = \frac{2\sigma \cos\theta \left(\frac{1}{r_t} - \frac{1}{r_p} \right)}{g(\rho_w - \rho_o)} \qquad (1)$$

Where h_c is the height of capillary rise in centimeters, σ is the interfacial tension between the NAPL and water (dyne/cm), θ is the contact angle measured through the wetting phase (water), r_t is the pore throat radius, r_p is the pore radius, g is the acceleration of

gravity (980 cm/sec^2), ρ_w is the density of water (g/cm^3), and ρ_o is the density of oil (g/cm^3). For well-sorted, well-rounded grains with rhombohedral packing and a diameter D (in cm), $r_p \approx 0.212D$ and $r_t \approx 0.077D$ (Fetter, 1993).

As demonstrated in our sand box experiments, for an interface trap to retain NAPL, the closure height must be greater than the height of capillary rise of the water into the NAPL. In the first sand box experiment, which used 1.5 mm diameter glass beads, the 4 cm. deep recess trapped oil and the zone of capillarity is less than 1 cm. thick (Figure 3F). Hobson's Formula predicts a capillary height of 2.2 cm for Marvel Mystery Oil™ (density of 0.83 g/cm^3, interfacial tension 24.3 dyne/cm, and contact angle 82°) for 1.5 mm diameter grains. Thus, Hobson's formula predicts that our 4-cm deep trap should retain Marvel Mystery Oil™.

The 6.7 cm capillary height predicted for 0.5 mm grains predicts no oil would be trapped in the second sand box experiment (Figure 4F) and none was. The predicted 16.8 cm capillary rise for 0.2 mm diameter grains compares favorably with the results of experiments 3 and 4. With a capillary rise of 16.8 cm, no oil should be trapped in a 4-cm. high trap, and none was. Thus, comparison the results of our visualization experiments with calculations made using Hobson's Formula suggest that it is reasonably accurate,

Some example calculations with Equation 1 iterated over grain-size for different nonaqueous phase liquids will help us illustrate the scale at which interface NAPL trapping is possible. Densities and were obtained from Mercer and Cohen (1990). The height of capillarity for water into gasoline increases significantly as grain-size decreases

(Figure 7). For example, if the aquifer is made up of well-sorted, granules (2 to 4 mm diameter) then the height of capillarity is between 5 and 8 cm. This suggests that for a coarse-grained interface trap to hold gasoline, it must have a closure height of greater than 5 to 8 cm. For a fine-grained sand, the capillary rise increases to between 1.6 and 4.2 meters. Therefore, the closure height in fine-grained sand must be significantly greater in order for interface trapping of gasoline to occur.

When toluene is considered (Figure 7), we see that for granules, capillarity is between 7 and 18 cm. Therefore, a slightly greater closure height is required to trap toluene than gasoline. For fine-grained sands, the needed closure height increases to between 2.2 and 5.9 meters.

The same type of calculations can be applied to DNAPLs. For DNAPL, capillarity forces water into the DNAPL body in a downward direction, thus the calculated height of capillary rise is negative. Therefore, we plotted the absolute value of capillary rise in Figure 7 to facilitate comparison between LNAPLs and DNAPLs. To trap trichloroethene (TCE) (Figure 7) requires a closure height greater than 2 to 5 cm in well-sorted granules. The necessary closure height rises to greater than 64cm to 1.7 M for well-sorted fine-grained sand. For ethylene dibromide (Figure 7), the height of capillarity for well-sorted granules is between 0.85 and 2.2 cm. For fine-grained sand it rises to between 27 and 71 cm.

From figure 7 and examination of Equation 1, we can develop some general conclusions:

1. For both LNAPLs and DNAPLs, the closer the immiscible fluid density is to that of water, the greater the capillary rise and therefore, the greater the closure height necessary to retain the NAPL in an interface trap.
2. Because DNAPLs have a greater range of density, smaller closure heights are needed in interface traps to trap some DNAPLs than are needed to trap LNAPLs.
3. In all cases the height of capillarity is inversely proportional to grain-size. Therefore, it becomes necessary to know grain-size distributions and sorting at contaminated sites as well as interface geometry in order to predict the potential importance of interface trapping.

Grain sorting is an important parameter. Hobson's Formula should predict behavior in well-sorted sands reasonably well. However, in a poorly-sorted sand, which consists of a wide mix of grain sizes, the smaller grains fill in the spaces between the larger grains. Therefore, it will be the pores and pore throats associated with the smaller grains that may control capillarity. Consequently, poorly-sorted sands, even though they may contain larger grains, will behave like finer-grained material.

Our investigation of closure volume and topographic variation at the micro-scale at sand shale interfaces demonstrated that there is potential for significant trapping volumes to exist at interfaces at the micro-scale. Even interfaces which have relief of only a few centimeters can generate closure volumes of more than 12 l/M^2 (which assuming a porosity of 30 percent yields trapping volumes of 3.6 l/M^2 or more.).

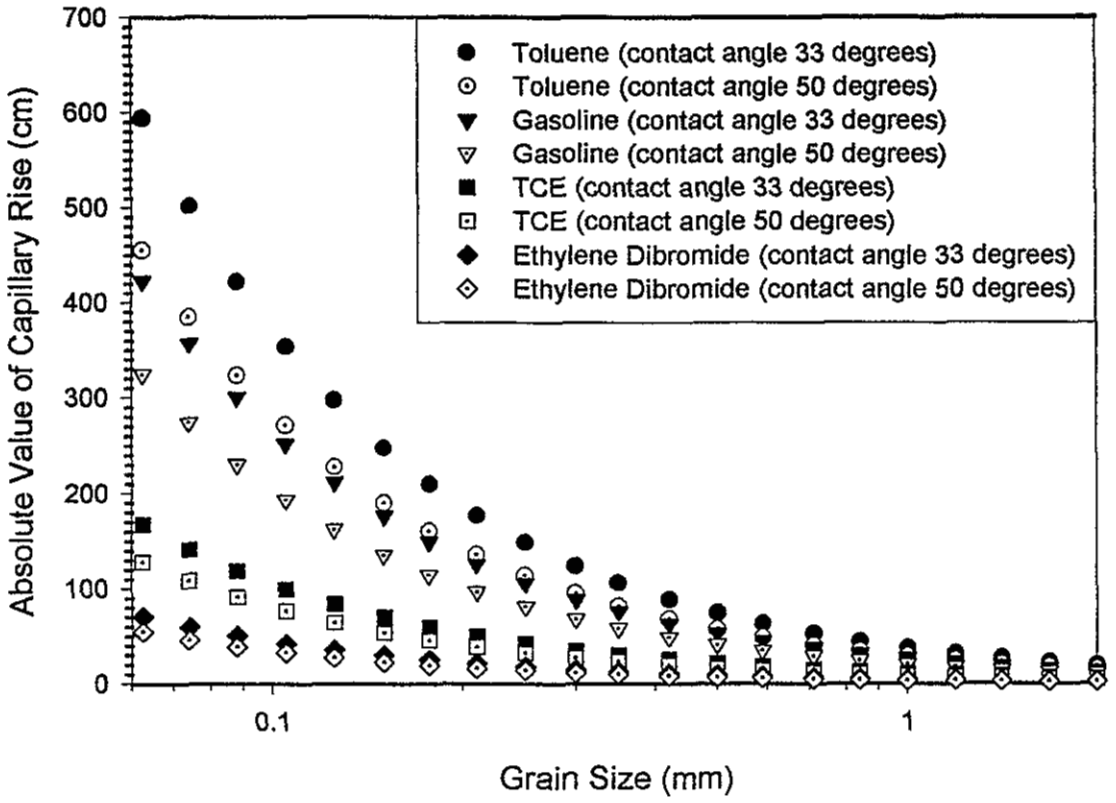

Figure 7. Height of capillary rise for two LNAPL compounds (gasoline and toluene) and two DNAPL compounds (trichloroethene and ethylene dibromide) versus grain-size. The grain-size range covered in this figure is from very fine-grained sand (0.0625 mm) to coarse-grained sand (2mm). Notice that very fine grained sands have a relatively large capillary rise while coarse-grained sands have low capillary rises. This suggests that traps containing fine-grained materials will require greater closure heights to trap NAPLs than traps containing coarse-grained materials. Interfacial tensions (dyne/cm) used in the calculations are: toluene 36.1, gasoline 50, TCE 34.5, and ethylene dibromide 36.5 (Mercer and Cohen, 1990).

However, as our sand box experiments and calculations have shown, closure heights of only a few centimeters are significant only when the grain-size is quite coarse. Coarse sands and gravels do exist at interfaces, so this is a potentially important observation.

Features in intermontane basins which can form environmentally significant NAPL traps include alluvial fan, fluvial, lacustrine, eolian, krenegenic, biogenic, pedogenic, volcanic, and tectonic features (Love et al., 1997). Future studies of these features with respect to potential NAPL trap closure height, volume, and distribution may lead to better quantification of NAPL-trapping features.

One of the most significant problems in site investigation is the scale at which a site can be examined. It is seldom cost effective to take borings spaced less than a few meters apart. Thus, with soil borings, only relatively large scale NAPL traps might be detected. Therefore, high resolution seismic techniques, electromagnetic techniques, or ground-penetrating radar, with vertical resolutions which approach one meter (Reynolds, 1997) show promise in detecting the presence of smaller-scale NAPL traps at contaminated sites. Reynolds (1997) presents a thorough, environmentally-oriented overview of various geophysical techniques for the reader who wishes to pursue this subject further. The fact that relatively small-scale traps might be important at NAPL contaminated sites points out the need for further research into micro-scale geophysical techniques which will allow noninvasive, three-dimensional delineation of the petrophysical properties of contaminated aquifers on a scale of tens of centimeters or less.

Although high-resolution geophysical techniques may someday delineate subsurface strata at adequate scales for effective, non-invasive site investigation, it is likely that a detailed understanding of permeability pathways and NAPL trapping processes will be needed to design remediation efforts. Thus geological studies of NAPL trapping processes and the permeability structure of potential NAPL traps may contribute to future remediation of NAPL contaminated sites.

SUMMARY AND CONCLUSIONS

Just as oil and gas are trapped in the subsurface, NAPLs can be trapped by smaller scale features at sand/shale interfaces with adequate closure. LNAPLs are less dense than water and tend to collect either at the water table or along the upper bounding surface of a confined aquifer where they can be trapped. DNAPLs are more dense than water and migrate to lower aquifer boundaries where they also can be trapped. NAPLs can also be trapped by pore-scale variations as residual saturation, however, discussion of residual saturation effects is outside the scope of this paper.

We measured micro-scale closure at the upper sand/shale interface at three sites for fluvial/alluvial and tidal flat depositional environments and found that closure volume ranged from a low of 5.55 l/M^2 to a high of 28.8 l/M^2. The average for all sites was 12.2 l/M^2. The area of each site ranged between 929 and 2090 cm^2. We could not measure closure height for individual features, so we measured the topographic variation at each site. Topographic variation ranged up to a maximum of 3.3 cm, and site means ranged between 1.3 and 2.4 cm.

We also conducted sand box experiments to see if these micro-scale features have NAPL trapping potential. Our results suggest that for NAPL to be trapped at greater than residual saturation, the closure height must be greater than the capillary rise of water into the NAPL. A closure height of 4.0 cm effectively trapped Marvel Mystery Oil™ when the average grain size was 1.5 mm, but failed to do so at smaller grain-sizes.

The results of our sand box visualization experiments and calculations with Hobson's Formula suggest that trap closure heights in the saturated zone must exceed the thickness of the zone of water capillarity before NAPL can be trapped at greater than

residual saturation. Capillary heights are a function of both grain size and the physical properties of the specific NAPL compound. For granule-sized materials, capillary heights are generally on the order of one to a few centimeters. For fine-grained sands, capillary heights are on the order of nearly one meter to as much as five meters or more. This suggests that trapping features containing coarse-grained material can retain NAPL at greater than residual saturation when closure heights are only a few centimeters. However, traps containing fine-grained sands, depending upon the specific NAPL compound, need closure heights on the order of one to five meters or more to trap NAPL. Thus, the micro-scale features we examined can only act as significant NAPL traps when the grain-size within the trap is quite coarse.

For both LNAPLs and DNAPLs, the closer the fluid density is to that of water, the greater the capillary rise and therefore, the greater the closure height necessary to retain the NAPL in an interface trap. NAPLs having densities differing greatly from that of water require the least closure to trap. In all cases the height of capillarity is inversely proportional to grain-size. Therefore, it becomes necessary to know grain-size distributions and sorting at contaminated sites as well as interface geometry in order to predict the potential importance of interface trapping.

REFERENCES CITED

Benzel, W. M. and D. L. Graf 1984. Studies of smectite membrane behavior: Importance of layer thickness and fabric in experiments at 20°C. Geochimica et Cosmochimica Acta. 48: 1769-1778.

Cohen, R. M. and Mercer, J. W., DNAPL Site Evaluation, C. K. Smoley, Publisher, CRC Press, Boca Raton, 339 p.

Coplen, T. B. and B. B. Hanshaw 1973. Ultrafiltration by a compacted membrane--I. Oxygen and hydrogen isotope fractionation. Geochimica et Cosmochimica Acta. 37:2205-2310.

Dahlberg, E. C., 1995, Applied Hydrodynamics in Petroleum Exploration, 2nd. ed., Springer Verlag, New York, 295 p.

Demir, I., 1988. Studies of smectite membrane behavior: Electrokinetic, osmotic, and isotopic fractionation processes at elevated pressures. Geochimica et Cosmochimica Acta. 52:727-737.

Feenstra, S. and Coburn, J., 1986, Subsurface contamination from spills of denser than water chlorinated solvents. California Water Pollution Control Assoc. Bull. 23: 26-34.

Fetter, C. W., 1993, Contaminant Hydrogeology, MacMillian Publishing Company, New York, 458 p.

Fritz, S. J., D. L. Hinz, and E. L. Grossman 1987. Hyperfiltration-induced fractionation of carbon isotopes. Geochemica et. Cosmochemica Acta. 51:1121-1134.

Fritz, S. J. and C. D. Eady 1985. Hyperfiltration-induced precipitation of calcite. Geochimica et Cosmochimica Acta. 49:761-768.

Fritz, S. J. and I. W. Marine 1983. Experimental support for a predictive osmotic model of clay membranes. Geochimica et Cosmochimica Acta. 47:1515-1522.

Haydon, P. R., and D. L. Graf 1986. Studies of smectite membrane behavior: Temperature dependence, 20-180°C. Geochemica et. Cosmochemica Acta. 50:115-121.

Kharaka, Y. K. and F. A. F. Berry 1973. Simultaneous flow of water and solutes through geologic membranes, I. Experimental investigation. Geochimica et Cosmochimica Acta. 37:2577-2603.

Kharaka, Y. K. and W. C. Smalley 1976. Flow of water and solutes through compacted clays. American Assoc. Pet. Geol. Bull. 60:973-980.

Levorsen, A. I., 1967, Geology of Petroleum, W. H. Freeman and Company, San Francisco, 724 p.

Love, D. W.; Whitworth, T. M.; Seager, W. R.; and Davis, J. M., Possible NAPL trapping features in semiarid-basin fill (abstract), Symposium no. 5, Environmental Geology and Hydrogeology of Intermontane Basins" for the South-Central/Rocky Mountain GSA Joint Meeting March 1997.

McKelvey, J. G. and I. H. Milne 1963. Permeability and salt-filtering properties of compacted clay. Clays and Clay Minerals (extended abstract). Monograph No. 13, p 250-251.Montgomery, J. M., 1985, Water Treatment and Design, John Wiley & Sons, New York, 696 p.

Mercer, J. W. and Cohen, R. M., 1990. A review of immiscable fluids in the subsurface: Properties, models, characterization, and remediation. Journal of Contaminant Hydrogeology. 6:107-163

Palmer, C. M., 1992, Principles of Contaminant Hydrogeology, Lewis Publishers, Boca Raton, 211 p.

Pinder, G. F., and Abriola, L., 1986, On the simulation of nonaqueous phase organic compounds in the subsurface. Water Resources Research, 22:109S-119S.

Reynolds, J. M., 1997, An introduction to applied and environmental geophysics, John Wiley & Sons, New York, 796 p.

Vroblesky, C. D.; Robertson, J. F.; and Rhodes, L. C., 1995, Stratigraphic trapping of spilled jet fuel beneath the water table, Groundwater Monitoring Review, Spring Volume, 177-183.

Whitworth, T. M., 1994, Possible Impact of Shallow Traps on Groundwater Remediation, Environmental Geology, 23:30-35.

Whitworth, T. M., Gamblin, G. B., and Fritz, S. J., 1993, A Simple Air-Stream Clay Separator, Journal of Sedimentary Petrology, v 66. pp. 716-718.

APPENDIX A: Site Information.

SITE 1
Location: Socorro, County, NM. Latitude 34°09'81" N, Longitude 106°45'00".
Elevation: 5096 feet.
Age: Permian
Formation: Yeso
Depositional Environment: Tidal Flat.

SITE 2
Location: Socorro, County, NM. Latitude 34°09'84" N, Longitude 106°45'00".
Elevation: 5110 feet
Age: Permian
Formation: Yeso.
Depositional Environment: Tidal Flat.

SITE 3
Location: Socorro, County, NM. Latitude 34°13'50" N, Longtitude106°59'06".
Elevation 4650
Age: Miocene.
Formation: Popotosa.
Depositional Environment: Distal alluvial fan/fluvial.

APPENDIX B: SAND/SHALE INTERFACE CLOSURE DATA

SITE 1 SUMMARY DATA
Location: Latitude 34°09'81" N, Longitude 106°45'00"
Elevation: 5096 feet.

Sample No.	Closure volume (cm^3)	Frame area (cm^2)	Standard Deviation (%)
2-21-97-1	94.803	1024.00	1.30
2-21-97-2	98.627	1024.00	3.60
2-21-97-3	143.700	1024.00	2.10
2-21-97-4	128.337	1024.00	0.70
2-21-97-5	114.657	1024.00	1.50
2-21-97-6	105.980	1024.00	0.60
2-21-97-7	109.490	1024.00	1.40
2-21-97-8	136.003	1024.00	0.90
2-21-97-9	115.230	1024.00	2.50
2-21-97-10	147.210	1024.00	1.60
2-21-97-11	116.923	1024.00	1.50
2-21-97-12	70.307	1024.00	2.30
2-21-97-13	169.090	1024.00	1.20
2-21-97-14	103.827	1024.00	1.00
2-21-97-15	123.510	1024.00	0.70
2-21-97-16	106.547	1024.00	0.90
2-21-97-17	77.930	1024.00	0.50
2-21-97-18	119.617	1024.00	2.40
2-21-97-19	69.913	1024.00	3.60
2-21-97-20	146.910	1024.00	4.10
2-21-97-21	104.063	1024.00	0.80

Closure Volume Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
21	114.413	25.517	5.568	99.177	169.090	69.913
Standard Deviation Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
21	1.676	1.059	0.231	3.600	4.100	0.500

Sample No.	Closure volume (cm^3)	Frame area (cm^2)	Standard Deviation (%)
5-19-97-1	131.703	1451.61	2.55
5-19-97-2	138.327	1451.61	2.62
5-19-97-3	151.577	1451.61	2.42
5-19-97-4	189.857	1451.61	0.80
5-19-97-5	225.027	1451.61	1.35
5-19-97-6	152.690	1451.61	1.82
5-19-97-7	188.357	1451.61	1.89
5-19-97-8	192.370	1451.61	1.27
5-19-97-9	178.867	1451.61	1.14
5-19-97-10	196.033	1451.61	2.18

Closure Volume Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
10	174.481	29.672	9.383	93.324	225.027	131.703
Standard Deviation Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
10	1.804	0.640	0.203	1.820	2.620	0.800

Sample No.	Closure volume (cm^3)	Frame area (cm^2)	Standard Deviation (%)
6-11-97-1	244.220	2090.32	1.00
6-11-97-2	239.837	2090.32	1.66
6-11-97-3	237.983	2090.32	0.86
6-11-97-4	204.943	2090.32	1.17
6-11-97-5	265.237	2090.32	0.90
6-11-97-6	214.897	2090.32	1.10
6-11-97-7	308.507	2090.32	1.35
6-11-97-8	252.540	2090.32	1.63
6-11-97-9	212.000	2090.32	0.83
6-11-97-10	220.773	2090.32	1.50

Closure Volume Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
10	240.094	30.772	9.731	103.564	308.507	204.943
Standard Deviation Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
10	1.200	0.317	0.100	0.830	1.660	0.830

SITE 1 RAW DATA

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-1	95.30	1024.00
2-21-97-1	93.36	1024.00
2-21-97-1	95.75	1024.00
2-21-97-1	101.36	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-2	121.24	1024.00
2-21-97-2	102.64	1024.00
2-21-97-2	96.07	1024.00
2-21-97-2	97.17	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-3	161.40	1024.00
2-21-97-3	145.95	1024.00
2-21-97-3	144.94	1024.00
2-21-97-3	140.21	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-4	159.10	1024.00
2-21-97-4	129.29	1024.00
2-21-97-4	128.35	1024.00
2-21-97-4	127.37	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-5	134.05	1024.00
2-21-97-5	115.36	1024.00
2-21-97-5	112.72	1024.00
2-21-97-5	115.89	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-6	105.86	1024.00
2-21-97-6	106.50	1024.00
2-21-97-6	105.28	1024.00
2-21-97-6	106.16	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-7	133.27	1024.00
2-21-97-7	107.99	1024.00
2-21-97-7	109.47	1024.00
2-21-97-7	111.01	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-8	171.33	1024.00
2-21-97-8	137.31	1024.00
2-21-97-8	135.89	1024.00
2-21-97-8	134.81	1024.00

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-9	115.77	1024.00
2-21-97-9	117.57	1024.00
2-21-97-9	116.14	1024.00
2-21-97-9	111.98	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-10	158.40	1024.00
2-21-97-10	149.76	1024.00
2-21-97-10	145.13	1024.00
2-21-97-10	146.74	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-11	126.29	1024.00
2-21-97-11	116.70	1024.00
2-21-97-11	118.78	1024.00
2-21-97-11	115.29	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-12	82.29	1024.00
2-21-97-12	72.07	1024.00
2-21-97-12	69.98	1024.00
2-21-97-12	68.87	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-13	168.22	1024.00
2-21-97-13	171.46	1024.00
2-21-97-13	168.09	1024.00
2-21-97-13	167.72	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-14	113.45	1024.00
2-21-97-14	103.91	1024.00
2-21-97-14	104.78	1024.00
2-21-97-14	102.79	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-15	125.22	1024.00
2-21-97-15	124.33	1024.00
2-21-97-15	123.63	1024.00
2-21-97-15	122.57	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-16	96.19	1024.00
2-21-97-16	107.59	1024.00
2-21-97-16	105.62	1024.00
2-21-97-16	106.43	1024.00

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-17	83.59	1024.00
2-21-97-17	77.54	1024.00
2-21-97-17	77.94	1024.00
2-21-97-17	78.31	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-18	116.79	1024.00
2-21-97-18	119.52	1024.00
2-21-97-18	122.54	1024.00
2-21-97-18	84.17	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-19	71.15	1024.00
2-21-97-19	68.82	1024.00
2-21-97-19	68.11	1024.00
2-21-97-19	72.81	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-20	142.59	1024.00
2-21-97-20	153.68	1024.00
2-21-97-20	144.80	1024.00
2-21-97-20	142.25	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
2-21-97-21	127.09	1024.00
2-21-97-21	98.37	1024.00
2-21-97-21	99.45	1024.00
2-21-97-21	99.96	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-1	133.11	1451.61
5-19-97-1	135.46	1451.61
5-19-97-1	129.01	1451.61
5-19-97-1	130.64	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-2	139.96	1451.61
5-19-97-2	134.88	1451.61
5-19-97-2	137.99	1451.61
5-19-97-2	142.11	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-3	162.71	1451.61
5-19-97-3	148.76	1451.61
5-19-97-3	150.24	1451.61
5-19-97-3	155.73	1451.61

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-4	185.36	1451.61
5-19-97-4	190.19	1451.61
5-19-97-4	191.18	1451.61
5-19-97-4	188.20	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-5	203.65	1451.61
5-19-97-5	222.57	1451.61
5-19-97-5	228.43	1451.61
5-19-97-5	224.08	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-6	128.20	1451.61
5-19-97-6	154.65	1451.61
5-19-97-6	150.73	1451.61
5-19-97-6	146.32	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-7	182.35	1451.61
5-19-97-7	185.23	1451.61
5-19-97-7	192.22	1451.61
5-19-97-7	187.62	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-8	131.00	1451.61
5-19-97-8	192.78	1451.61
5-19-97-8	189.75	1451.61
5-19-97-8	194.58	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-9	142.51	1451.61
5-19-97-9	176.70	1451.61
5-19-97-9	179.17	1451.61
5-19-97-9	180.73	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-19-97-10	156.30	1451.61
5-19-97-10	198.60	1451.61
5-19-97-10	191.10	1451.61
5-19-97-10	198.40	1451.61
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-1	249.52	2090.32
6-11-97-1	241.50	2090.32
6-11-97-1	246.16	2090.32
6-11-97-1	245.00	2090.32

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-2	257.63	2090.32
6-11-97-2	235.61	2090.32
6-11-97-2	240.36	2090.32
6-11-97-2	243.54	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-3	246.52	2090.32
6-11-97-3	240.29	2090.32
6-11-97-3	237.24	2090.32
6-11-97-3	236.42	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-4	167.66	2090.32
6-11-97-4	202.43	2090.32
6-11-97-4	205.20	2090.32
6-11-97-4	207.20	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-5	269.39	2090.32
6-11-97-5	265.18	2090.32
6-11-97-5	267.64	2090.32
6-11-97-5	262.89	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-6	249.91	2090.32
6-11-97-6	213.97	2090.32
6-11-97-6	217.59	2090.32
6-11-97-6	213.13	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-7	267.09	2090.32
6-11-97-7	303.86	2090.32
6-11-97-7	311.87	2090.32
6-11-97-7	309.79	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-8	217.17	2090.32
6-11-97-8	248.98	2090.32
6-11-97-8	257.04	2090.32
6-11-97-8	251.60	2090.32
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-9	205.99	2090.32
6-11-97-9	213.92	2090.32
6-11-97-9	211.63	2090.32
6-11-97-9	210.45	2090.32

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
6-11-97-10	218.21	2090.32
6-11-97-10	223.32	2090.32
6-11-97-10	221.98	2090.32
6-11-97-10	217.02	2090.32

SITE 2 SUMMARY DATA

Location: 34°09'84" N latitude, 106°45'00" E? longitude
Elevation: 5110 feet

Sample No.	Closure volume (cm^3)	Frame area (cm^2)	Standard Deviation (%)
3-21-97-1	91.637	1024.00	1.12
3-21-97-2	95.873	1024.00	1.30
3-21-97-3	98.457	1024.00	0.90
3-21-97-4	294.623	1024.00	0.80
3-21-97-5	285.112	1024.00	1.36
3-21-97-6	107.653	1024.00	1.87
3-21-97-7	168.547	1024.00	1.53
3-21-97-8	227.390	1024.00	1.07
3-21-97-9	56.787	1024.00	1.92
3-21-97-10	129.553	1024.00	1.28
3-21-97-11	74.290	1024.00	1.23
3-21-97-12	124.723	1024.00	1.29

Closure Volume Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
12	146.220	80.677	23.289	237.836	294.623	56.787
Standard Deviation Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
12	1.306	0.339	0.0979	1.120	1.920	0.800

Site 2 RAW DATA

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-1	91.53	1024.00
3-21-97-1	90.90	1024.00
3-21-97-1	92.81	1024.00
3-21-97-1	91.20	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-2	92.49	1024.00
3-21-97-2	95.91	1024.00
3-21-97-2	97.10	1024.00
3-21-97-2	94.61	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-3	98.69	1024.00
3-21-97-3	97.66	1024.00
3-21-97-3	98.30	1024.00
3-21-97-3	99.41	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-4	297.75	1024.00
3-21-97-4	297.42	1024.00
3-21-97-4	293.68	1024.00
3-21-97-4	292.77	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-5	288.72	1024.00
3-21-97-5	287.80	1024.00
3-21-97-5	280.46	1024.00
3-21-97-5	283.51	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-6	102.30	1024.00
3-21-97-6	105.33	1024.00
3-21-97-6	108.75	1024.00
3-21-97-6	108.88	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-7	168.79	1024.00
3-21-97-7	166.42	1024.00
3-21-97-7	167.80	1024.00
3-21-97-7	171.41	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-8	205.24	1024.00
3-21-97-8	226.63	1024.00
3-21-97-8	230.11	1024.00
3-21-97-8	225.43	1024.00

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-9	58.39	1024.00
3-21-97-9	56.07	1024.00
3-21-97-9	58.04	1024.00
3-21-97-9	56.25	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-10	154.70	1024.00
3-21-97-10	131.20	1024.00
3-21-97-10	129.57	1024.00
3-21-97-10	127.89	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-11	76.77	1024.00
3-21-97-11	74.41	1024.00
3-21-97-11	75.14	1024.00
3-21-97-11	73.32	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
3-21-97-12	134.56	1024.00
3-21-97-12	124.49	1024.00
3-21-97-12	126.43	1024.00
3-21-97-12	123.25	1024.00

Closure Volume Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
12	146.220	80.677	23.289	237.836	294.623	56.787
Standard Deviation Statistics						
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
12	1.306	0.339	0.0979	1.120	1.920	0.800

SITE 3 SUMMARY DATA
34°13'50"
106°59'06"
Elevation 4650

Sample No.	Closure volume (cm^3)	Frame area (cm^2)	Standard Deviation (%)
5-2-97-1	135.873	1024.00	1.49
5-2-97-2	152.270	1024.00	2.46
5-2-97-3	95.157	1024.00	1.32
5-2-97-4	125.827	1024.00	1.03
5-2-97-5	137.337	1024.00	0.70
5-2-97-6	116.843	1024.00	1.10
5-2-97-7	91.353	1024.00	0.62
5-2-97-8	118.150	1024.00	1.53
5-2-97-9	115.680	1024.00	1.85

Closure Volume Statistics						
Size	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
9	120.943	19.652	6.551	60.917	152.270	91.353
Standard Deviation Statistics						
Size	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum
9	1.344	0.576	0.192	1.840	2.460	0.620

Site 3 Raw Data

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-1	137.94	1024.00
5-2-97-1	136.56	1024.00
5-2-97-1	133.60	1024.00
5-2-97-1	137.46	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-2	197.56	1024.00
5-2-97-2	155.07	1024.00
5-2-97-2	150.44	1024.00
5-2-97-2	151.30	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-3	95.84	1024.00
5-2-97-3	96.45	1024.00
5-2-97-3	95.08	1024.00
5-2-97-3	93.94	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-4	106.98	1024.00
5-2-97-4	125.34	1024.00
5-2-97-4	127.30	1024.00
5-2-97-4	124.84	1024.00

Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-5	126.87	1024.00
5-2-97-5	136.76	1024.00
5-2-97-5	136.83	1024.00
5-2-97-5	138.42	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-6	92.31	1024.00
5-2-97-6	118.26	1024.00
5-2-97-6	115.74	1024.00
5-2-97-6	116.53	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-7	98.32	1024.00
5-2-97-7	91.26	1024.00
5-2-97-7	91.96	1024.00
5-2-97-7	90.84	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-8	132.17	1024.00
5-2-97-8	118.84	1024.00
5-2-97-8	119.51	1024.00
5-2-97-8	116.10	1024.00
Sample No.	Closure volume (cm^3)	Frame area (cm^2)
5-2-97-9	109.38	1024.00
5-2-97-9	114.20	1024.00
5-2-97-9	114.71	1024.00
5-2-97-9	118.13	1024.00

APPENDIX C: ELEVATION MEASUREMENTS

Site 1

Sample No 2-21-97-1, Frame area 1024 (cm^2)			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.153	0.918
5	0	6.651	0.416
10	0	6.968	0.733
15	0	7.301	1.066
20	0	7.695	1.460
25	0	8.487	2.252
0	5	7.642	1.407
5	5	6.854	0.619
10	5	7.070	0.835
15	5	7.362	1.127
20	5	7.231	0.996
25	5	7.096	0.861
0	10	6.701	0.466
5	10	7.255	1.020
10	10	6.465	0.230
15	10	6.235	0.000
20	10	6.427	0.192
25	10	7.231	0.996
0	15	7.486	1.251
5	15	7.254	1.019
10	15	7.772	1.537
15	15	7.316	1.081
20	15	7.308	1.073
25	15	7.553	1.318
0	20	7.421	1.186
5	20	7.207	0.972
10	20	7.243	1.008
15	20	7.504	1.269
20	20	7.351	1.116
25	20	7.719	1.484
0	25	7.271	1.036
5	25	7.469	1.234
10	25	7.619	1.384
15	25	7.554	1.319
20	25	7.897	1.662
25	25	7.349	1.114

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	1.046	0.435	0.0724	2.252	2.252	0.000	1.070
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.889	1.293	37.657	45.998	0.147	-0.172	1.407	

Sample No 2-21-97-2, Frame area 1024 (cm^2)			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.178	0.159
5	0	7.725	0.706
10	0	7.653	0.634
15	0	7.504	0.485
20	0	7.582	0.563
25	0	7.797	0.778
0	5	7.766	0.747
5	5	7.758	0.739
10	5	7.630	0.611
15	5	7.632	0.613
20	5	7.093	0.074
25	5	7.119	0.100
0	10	7.494	0.475
5	10	7.591	0.572
10	10	7.690	0.671
15	10	7.780	0.761
20	10	7.499	0.480
25	10	7.492	0.473
0	15	7.770	0.751
5	15	7.835	0.816
10	15	7.787	0.768
15	15	7.897	0.878
20	15	7.381	0.362
25	15	7.376	0.357
0	20	7.376	0.357
5	20	7.580	0.561
10	20	7.491	0.472
15	20	7.576	0.557
20	20	7.467	0.448
25	20	7.560	0.541
0	25	7.236	0.217
5	25	7.209	0.190
10	25	7.468	0.449
15	25	7.681	0.662
20	25	7.926	0.907
25	25	7.741	0.722

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.546	0.217	0.0361	0.833	0.907	0.0740	0.562
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.449	0.730	19.656	12.373	0.0733	-0.539	-0.308	

Sample No 2-21-97-3, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.644	0.606
5	0	7.532	0.494
10	0	7.537	0.499
15	0	7.573	0.535
20	0	7.856	0.818
25	0	7.959	0.921
0	5	7.372	0.334
5	5	7.786	0.748
10	5	7.536	0.498
15	5	7.504	0.466
20	5	7.713	0.675
25	5	7.639	0.601
0	10	7.597	0.559
5	10	7.585	0.547
10	10	7.505	0.467
15	10	7.674	0.636
20	10	7.503	0.465
25	10	7.384	0.346
0	15	7.451	0.413
5	15	7.406	0.368
10	15	7.038	0.000
15	15	7.148	0.110
20	15	7.323	0.285
25	15	7.541	0.503
0	20	7.204	0.166
5	20	7.654	0.616
10	20	7.570	0.532
15	20	7.574	0.536
20	20	7.668	0.630
25	20	7.539	0.501
0	25	7.527	0.489
5	25	7.515	0.477
10	25	7.367	0.329
15	25	7.207	0.169
20	25	7.623	0.585
25	25	7.892	0.854

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.494	0.197	0.0329	0.921	0.921	0.000	0.500
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.390	0.603	17.778	10.140	0.0667	-0.307	0.670	

Sample No 2-21-97-4, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Elevation (cm)
0	0	7.103	0.485
5	0	6.924	0.306
10	0	7.087	0.469
15	0	7.141	0.523
20	0	7.120	0.502
25	0	6.743	0.125
0	5	6.744	0.126
5	5	6.682	0.064
10	5	7.083	0.465
15	5	7.235	0.617
20	5	6.970	0.352
25	5	7.195	0.577
0	10	6.788	0.170
5	10	6.618	0.000
10	10	6.964	0.346
15	10	7.117	0.499
20	10	7.170	0.552
25	10	7.065	0.447
0	15	7.161	0.543
5	15	6.650	0.032
10	15	6.936	0.318
15	15	7.172	0.554
20	15	7.193	0.575
25	15	6.975	0.357
0	20	7.091	0.473
5	20	6.945	0.327
10	20	7.253	0.635
15	20	7.247	0.629
20	20	7.154	0.536
25	20	7.114	0.496
0	25	7.486	0.868
5	25	6.942	0.324
10	25	7.059	0.441
15	25	6.932	0.314
20	25	7.471	0.853
25	25	7.378	0.760

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.435	0.209	0.0349	0.868	0.868	0.000	0.471
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.321	0.553	15.660	8.347	0.0709	-0.210	0.0391	

Sample No 2-21-97-5, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Elevation (cm)
0	0	7.685	0.665
5	0	7.633	0.613
10	0	7.593	0.573
15	0	7.582	0.562
20	0	7.210	0.190
25	0	7.172	0.152
0	5	7.655	0.635
5	5	7.526	0.506
10	5	7.435	0.415
15	5	7.250	0.230
20	5	7.057	0.037
25	5	7.189	0.169
0	10	7.640	0.620
5	10	7.485	0.465
10	10	7.492	0.472
15	10	7.141	0.121
20	10	7.337	0.317
25	10	7.097	0.077
0	15	7.317	0.297
5	15	7.643	0.623
10	15	7.268	0.248
15	15	6.985	-0.035
20	15	7.073	0.053
25	15	7.202	0.182
0	20	7.333	0.313
5	20	7.419	0.399
10	20	7.269	0.249
15	20	7.032	0.012
20	20	7.162	0.142
25	20	7.020	0.000
0	25	7.661	0.641
5	25	7.378	0.358
10	25	7.382	0.362
15	25	7.173	0.153
20	25	7.171	0.151
25	25	7.081	0.061

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.341	0.216	0.0360	0.700	0.700	0.000	0.308
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.181	0.524	12.288	5.831	0.0732	0.239	-1.228	

Sample No 2-21-97-6, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.106	0.670
5	0	7.006	0.570
10	0	6.689	0.253
15	0	6.921	0.485
20	0	6.521	0.085
25	0	6.536	0.100
0	5	6.659	0.223
5	5	6.843	0.407
10	5	6.679	0.243
15	5	6.675	0.239
20	5	6.699	0.263
25	5	6.436	0.000
0	10	7.577	1.141
5	10	7.332	0.896
10	10	6.715	0.279
15	10	6.705	0.269
20	10	6.942	0.506
25	10	6.671	0.235
0	15	7.418	0.982
5	15	7.084	0.648
10	15	6.949	0.513
15	15	7.114	0.678
20	15	6.879	0.443
25	15	7.003	0.567
0	20	7.286	0.850
5	20	6.981	0.545
10	20	7.144	0.708
15	20	7.161	0.725
20	20	7.133	0.697
25	20	7.049	0.613
0	25	7.347	0.911
5	25	7.221	0.785
10	25	7.354	0.918
15	25	7.128	0.692
20	25	7.054	0.618
25	25	7.548	1.112

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.552	0.293	0.0489	1.141	1.141	0.000	0.569
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.266	0.716	19.869	13.976	0.0992	0.0797	-0.683	

Sample No 2-21-97-7, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0.00	0.00	7.768	0.676
5	0	7.830	0.738
10	0	7.665	0.573
15	0	7.622	0.530
20	0	7.531	0.439
25	0	8.093	1.001
0	5	7.644	0.552
5	5	7.686	0.594
10	5	7.519	0.427
15	5	7.333	0.241
20	5	7.602	0.510
25	5	7.666	0.574
0	10	7.419	0.327
5	10	7.575	0.483
10	10	7.449	0.357
15	10	7.453	0.361
20	10	7.535	0.443
25	10	7.404	0.312
0	15	7.360	0.268
5	15	7.562	0.470
10	15	7.341	0.249
15	15	7.175	0.083
20	15	7.194	0.102
25	15	7.375	0.283
0	20	7.159	0.067
5	20	7.195	0.103
10	20	7.329	0.237
15	20	7.513	0.421
20	20	7.365	0.273
25	20	7.432	0.340
0	25	7.431	0.339
5	25	7.292	0.200
10	25	7.273	0.181
15	25	7.469	0.377
20	25	7.590	0.498
25	25	7.092	0.000

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.379	0.207	0.0344	1.001	1.001	0.000	0.359
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.245	0.504	13.629	6.653	0.0699	0.606	1.102	

Sample No 2-21-97-8, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	5.757	0.324
5	0	5.433	0.000
10	0	6.176	0.743
15	0	7.506	2.073
20	0	6.391	0.958
25	0	7.107	1.674
0	5	7.321	1.888
5	5	5.479	0.046
10	5	6.215	0.782
15	5	6.293	0.860
20	5	7.109	1.676
25	5	7.035	1.602
0	10	5.895	0.462
5	10	6.641	1.208
10	10	6.593	1.160
15	10	7.173	1.740
20	10	7.070	1.637
25	10	7.083	1.650
0	15	6.429	0.996
5	15	7.215	1.782
10	15	7.308	1.875
15	15	7.828	2.395
20	15	7.228	1.795
25	15	7.410	1.977
0	20	7.143	1.710
5	20	6.305	0.872
10	20	7.120	1.687
15	20	7.002	1.569
20	20	7.415	1.982
25	20	6.464	1.031
0	25	7.458	2.025
5	25	6.020	0.587
10	25	6.244	0.811
15	25	6.354	0.921
20	25	7.184	1.751
25	25	7.107	1.674

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	1.331	0.609	0.101	2.395	2.395	0.000	1.619
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.866	1.767	47.923	76.768	0.206	-0.537	-0.603	

Sample No 2-21-97-9, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.072	0.00
5	0	7.171	0.10
10	0	7.353	0.28
15	0	7.638	0.57
20	0	7.752	0.68
25	0	7.706	0.63
0	5	7.378	0.31
5	5	7.372	0.30
10	5	7.610	0.54
15	5	7.728	0.66
20	5	7.694	0.62
25	5	7.520	0.45
0	10	7.374	0.30
5	10	7.401	0.33
10	10	7.553	0.48
15	10	7.420	0.35
20	10	7.632	0.56
25	10	7.623	0.55
0	15	7.199	0.13
5	15	7.461	0.39
10	15	7.303	0.23
15	15	7.214	0.14
20	15	7.827	0.76
25	15	7.620	0.55
0	20	7.257	0.19
5	20	7.305	0.23
10	20	7.263	0.19
15	20	7.570	0.50
20	20	7.563	0.49
25	20	7.676	0.60
0	25	7.312	0.24
5	25	7.305	0.23
10	25	7.264	0.19
15	25	7.868	0.80
20	25	7.672	0.60
25	25	7.246	0.17

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.398	0.207	0.0345	0.800	0.800	0.000	0.370
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.230	0.565	14.340	7.213	0.0701	0.0865	-1.051	

Sample No 2-21-97-10, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.125	0.496
5	0	7.361	0.732
10	0	7.503	0.874
15	0	7.624	0.995
20	0	7.418	0.789
25	0	7.129	0.500
0	5	7.289	0.660
5	5	6.851	0.222
10	5	7.197	0.568
15	5	7.516	0.887
20	5	7.771	1.142
25	5	7.124	0.495
0	10	7.100	0.471
5	10	8.008	1.379
10	10	7.388	0.759
15	10	6.919	0.290
20	10	6.830	0.201
25	10	6.796	0.167
0	15	7.444	0.815
5	15	7.326	0.697
10	15	7.410	0.781
15	15	7.007	0.378
20	15	7.138	0.509
25	15	7.074	0.445
0	20	7.135	0.506
5	20	7.664	1.035
10	20	7.326	0.697
15	20	6.629	0.000
20	20	7.071	0.442
25	20	7.433	0.804
0	25	6.949	0.320
5	25	7.190	0.561
10	25	7.364	0.735
15	25	7.378	0.749
20	25	7.155	0.526
25	25	7.234	0.605

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.618	0.285	0.0476	1.379	1.379	0.000	0.587
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.458	0.785	22.232	16.580	0.0966	0.290	0.534	

Sample No 2-21-97-10, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.125	0.496
5	0	7.361	0.732
10	0	7.503	0.874
15	0	7.624	0.995
20	0	7.418	0.789
25	0	7.129	0.500
0	5	7.289	0.660
5	5	6.851	0.222
10	5	7.197	0.568
15	5	7.516	0.887
20	5	7.771	1.142
25	5	7.124	0.495
0	10	7.100	0.471
5	10	8.008	1.379
10	10	7.388	0.759
15	10	6.919	0.290
20	10	6.830	0.201
25	10	6.796	0.167
0	15	7.444	0.815
5	15	7.326	0.697
10	15	7.410	0.781
15	15	7.007	0.378
20	15	7.138	0.509
25	15	7.074	0.445
0	20	7.135	0.506
5	20	7.664	1.035
10	20	7.326	0.697
15	20	6.629	0.000
20	20	7.071	0.442
25	20	7.433	0.804
0	25	6.949	0.320
5	25	7.190	0.561
10	25	7.364	0.735
15	25	7.378	0.749
20	25	7.155	0.526
25	25	7.234	0.605

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.618	0.285	0.0476	1.379	1.379	0.000	0.587
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.458	0.785	22.232	16.580	0.0966	0.290	0.534	

Sample No 2-21-97-11, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.551	0.811
5	0	7.598	0.858
10	0	7.707	0.967
15	0	7.418	0.678
20	0	7.251	0.511
25	0	7.593	0.853
0	5	7.066	0.326
5	5	7.172	0.432
10	5	7.140	0.400
15	5	7.036	0.296
20	5	7.033	0.293
25	5	7.433	0.693
0	10	6.796	0.056
5	10	6.756	0.016
10	10	7.067	0.327
15	10	6.927	0.187
20	10	7.066	0.326
25	10	7.016	0.276
0	15	6.740	0.000
5	15	6.752	0.012
10	15	6.919	0.179
15	15	7.098	0.358
20	15	7.288	0.548
25	15	6.959	0.219
0	20	6.968	0.228
5	20	7.097	0.357
10	20	7.235	0.495
15	20	7.327	0.587
20	20	7.478	0.738
25	20	7.483	0.743
0	25	7.271	0.531
5	25	7.273	0.533
10	25	7.344	0.604
15	25	7.245	0.505
20	25	7.298	0.558
25	25	7.387	0.647

Topographic variation statistical analysis:							
n	Mean	Std Dev	Std. Error	Range	Maximum	Minimum	Median
36	0.449	0.254	0.0423	0.967	0.967	0.000	0.464
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.284	0.625	16.148	9.502	0.0860	0.0400	-0.656	

Sample No 2-21-97-12, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.068	0.649
5	0	7.124	0.705
10	0	7.364	0.945
15	0	7.369	0.950
20	0	7.026	0.607
25	0	6.934	0.515
0	5	6.912	0.493
5	5	6.481	0.062
10	5	7.315	0.896
15	5	7.024	0.605
20	5	7.294	0.875
25	5	6.975	0.556
0	10	7.189	0.770
5	10	7.046	0.627
10	10	6.899	0.480
15	10	6.749	0.330
20	10	6.687	0.268
25	10	6.791	0.372
0	15	6.921	0.502
5	15	7.011	0.592
10	15	7.004	0.585
15	15	6.856	0.437
20	15	6.779	0.360
25	15	6.750	0.331
0	20	6.749	0.330
5	20	6.702	0.283
10	20	6.419	0.000
15	20	7.144	0.725
20	20	7.888	1.469
25	20	6.707	0.288
0	25	7.460	1.041
5	25	6.534	0.115
10	25	6.752	0.333
15	25	7.121	0.702
20	25	7.548	1.129
25	25	7.152	0.733

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.574	0.310	0.0516	1.469	1.469	0.000	0.571
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.332	0.729	20.660	15.216	0.105	0.609	0.803	

Sample No 2-21-97-13, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.308	0.267
5	0	7.468	0.427
10	0	7.516	0.475
15	0	7.310	0.269
20	0	7.479	0.438
25	0	7.598	0.557
0	5	7.512	0.471
5	5	7.320	0.279
10	5	7.248	0.207
15	5	7.305	0.264
20	5	7.799	0.758
25	5	7.245	0.204
0	10	7.524	0.483
5	10	7.561	0.520
10	10	7.397	0.356
15	10	7.623	0.582
20	10	7.421	0.380
25	10	7.304	0.263
0	15	7.754	0.713
5	15	7.520	0.479
10	15	7.708	0.667
15	15	7.303	0.262
20	15	7.322	0.281
25	15	7.288	0.247
0	20	7.327	0.286
5	20	7.518	0.477
10	20	7.736	0.695
15	20	7.275	0.234
20	20	7.268	0.227
25	20	7.452	0.411
0	25	7.360	0.319
5	25	7.330	0.289
10	25	7.041	0.000
15	25	7.547	0.506
20	25	7.552	0.511
25	25	7.406	0.365

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.394	0.168	0.0279	0.758	0.758	0.000	0.373
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.266	0.495	14.169	6.559	0.0567	0.292	-0.0444	

Sample No 2-21-97-14, Frame area 1175.8 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	8.703	1.722
5	0	7.705	0.724
10	0	7.204	0.223
15	0	7.385	0.404
20	0	7.614	0.633
25	0	7.768	0.787
0	5	7.971	0.990
5	5	7.726	0.745
10	5	7.192	0.211
15	5	7.283	0.302
20	5	7.399	0.418
25	5	7.984	1.003
0	10	7.758	0.777
5	10	7.816	0.835
10	10	7.501	0.520
15	10	7.048	0.067
20	10	7.602	0.621
25	10	7.151	0.170
0	15	8.057	1.076
5	15	8.470	1.489
10	15	7.432	0.451
15	15	6.981	0.000
20	15	7.778	0.797
25	15	7.664	0.683
0	20	8.325	1.344
5	20	7.860	0.879
10	20	7.760	0.779
15	20	7.513	0.532
20	20	7.055	0.074
25	20	7.651	0.670
0	25	8.244	1.263
5	25	8.041	1.060
10	25	8.091	1.110
15	25	7.566	0.585
20	25	7.235	0.254
25	25	7.639	0.658

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.690	0.407	0.0678	1.722	1.722	0.000	0.677
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.411	0.935	24.856	22.958	0.138	0.430	0.0551	

Sample No 2-21-97-15, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.543	0.960
5	0	7.561	0.978
10	0	7.186	0.603
15	0	7.907	1.324
20	0	7.295	0.712
25	0	7.658	1.075
0	5	7.547	0.964
5	5	7.587	1.004
10	5	7.439	0.856
15	5	7.966	1.383
20	5	7.114	0.531
25	5	7.641	1.058
0	10	7.689	1.106
5	10	7.594	1.011
10	10	7.297	0.714
15	10	6.871	0.288
20	10	6.583	0.000
25	10	7.341	0.758
0	15	6.985	0.402
5	15	7.263	0.680
10	15	7.521	0.938
15	15	7.227	0.644
20	15	7.149	0.566
25	15	7.012	0.429
0	20	7.228	0.645
5	20	7.693	1.110
10	20	7.859	1.276
15	20	7.663	1.080
20	20	7.545	0.962
25	20	7.465	0.882
0	25	7.548	0.965
5	25	7.608	1.025
10	25	7.526	0.943
15	25	7.609	1.026
20	25	7.514	0.931
25	25	7.612	1.029

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.857	0.294	0.0490	1.383	1.383	0.000	0.952
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.663	1.027	30.858	29.472	0.0994	-0.815	0.926	

Sample No 2-21-97-16, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.694	0.056
5	0	7.952	0.314
10	0	8.152	0.514
15	0	8.121	0.483
20	0	7.991	0.353
25	0	8.041	0.403
0	5	8.351	0.713
5	5	7.963	0.325
10	5	7.974	0.336
15	5	7.899	0.261
20	5	8.343	0.705
25	5	8.607	0.969
0	10	8.328	0.690
5	10	8.140	0.502
10	10	8.270	0.632
15	10	8.207	0.569
20	10	8.293	0.655
25	10	8.672	1.034
0	15	8.211	0.573
5	15	7.638	0.000
10	15	8.663	1.025
15	15	8.522	0.884
20	15	8.414	0.776
25	15	8.619	0.981
0	20	8.394	0.756
5	20	7.978	0.340
10	20	8.544	0.906
15	20	8.263	0.625
20	20	8.401	0.763
25	20	8.716	1.078
0	25	8.314	0.676
5	25	8.112	0.474
10	25	8.658	1.020
15	25	8.380	0.742
20	25	8.630	0.992
25	25	8.824	1.186

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.648	0.293	0.0488	1.186	1.186	0.000	0.665
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.439	0.895	23.311	18.098	0.0991	-0.211	-0.505	

Sample No 2-21-97-17, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	8.897	1.668
5	0	8.570	1.341
10	0	7.720	0.491
15	0	8.236	1.007
20	0	8.559	1.330
25	0	8.117	0.888
0	5	7.762	0.533
5	5	7.901	0.672
10	5	7.729	0.500
15	5	8.099	0.870
20	5	7.906	0.677
25	5	8.082	0.853
0	10	7.821	0.592
5	10	7.780	0.551
10	10	7.229	0.000
15	10	7.249	0.020
20	10	8.014	0.785
25	10	8.180	0.951
0	15	8.438	1.209
5	15	8.116	0.887
10	15	8.162	0.933
15	15	8.110	0.881
20	15	8.015	0.786
25	15	8.002	0.773
0	20	8.284	1.055
5	20	8.132	0.903
10	20	8.348	1.119
15	20	8.361	1.132
20	20	8.185	0.956
25	20	7.887	0.658
0	25	8.447	1.218
5	25	8.254	1.025
10	25	8.435	1.206
15	25	8.324	1.095
20	25	8.183	0.954
25	25	7.895	0.666

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.866	0.336	0.0559	1.668	1.668	0.000	0.887
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.669	1.075	31.185	30.957	0.114	-0.458	1.307	

Sample No 2-21-97-18, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.777	1.599
5	0	7.245	1.067
10	0	7.162	0.984
15	0	7.054	0.876
20	0	6.573	0.395
25	0	6.178	0.000
0	5	7.140	0.962
5	5	7.014	0.836
10	5	6.624	0.446
15	5	7.161	0.983
20	5	6.566	0.388
25	5	6.552	0.374
0	10	7.380	1.202
5	10	7.182	1.004
10	10	7.023	0.845
15	10	6.610	0.432
20	10	6.956	0.778
25	10	6.547	0.369
0	15	6.706	0.528
5	15	7.224	1.046
10	15	6.969	0.791
15	15	7.016	0.838
20	15	6.826	0.648
25	15	6.209	0.031
0	20	6.856	0.678
5	20	7.007	0.829
10	20	6.811	0.633
15	20	6.867	0.689
20	20	7.082	0.904
25	20	6.496	0.318
0	25	6.915	0.737
5	25	6.939	0.761
10	25	6.806	0.628
15	25	7.166	0.988
20	25	7.630	1.452
25	25	7.122	0.944

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.750	0.342	0.0570	1.599	1.599	0.000	0.784
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.487	0.972	26.983	24.316	0.116	0.0328	0.581	

	Sample No 2-21-97-19,	Frame area 1024 cm^2	
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.095	0.488
5	0	7.326	0.719
10	0	7.431	0.824
15	0	7.408	0.801
20	0	7.633	1.026
25	0	7.627	1.020
0	5	7.326	0.719
5	5	7.451	0.844
10	5	7.589	0.982
15	5	7.358	0.751
20	5	7.309	0.702
25	5	7.123	0.516
0	10	7.533	0.926
5	10	7.254	0.647
10	10	7.142	0.535
15	10	6.925	0.318
20	10	6.713	0.106
25	10	6.607	0.000
0	15	7.289	0.682
5	15	7.208	0.601
10	15	7.311	0.704
15	15	6.935	0.328
20	15	6.658	0.051
25	15	6.759	0.152
0	20	7.458	0.851
5	20	7.833	1.226
10	20	7.764	1.157
15	20	7.912	1.305
20	20	7.202	0.595
25	20	7.588	0.981
0	25	7.381	0.774
5	25	7.571	0.964
10	25	7.825	1.218
15	25	7.547	0.940
20	25	7.076	0.469
25	25	7.174	0.567

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.708	0.329	0.0548	1.305	1.305	0.000	0.719
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.526	0.952	25.489	21.838	0.111	-0.390	-0.194	

Sample No 2-21-97-20, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	9.083	1.338
5	0	9.080	1.335
10	0	8.930	1.185
15	0	8.435	0.690
20	0	8.258	0.513
25	0	7.745	0.000
0	5	8.811	1.066
5	5	8.623	0.878
10	5	8.792	1.047
15	5	7.952	0.207
20	5	8.114	0.369
25	5	8.238	0.493
0	10	9.214	1.469
5	10	8.558	0.813
10	10	8.030	0.285
15	10	8.416	0.671
20	10	7.922	0.177
25	10	8.531	0.786
0	15	8.830	1.085
5	15	9.038	1.293
10	15	8.529	0.784
15	15	7.852	0.107
20	15	8.065	0.320
25	15	8.091	0.346
0	20	8.736	0.991
5	20	9.094	1.349
10	20	8.108	0.363
15	20	8.366	0.621
20	20	8.379	0.634
25	20	8.052	0.307
0	25	8.911	1.166
5	25	9.102	1.357
10	25	8.698	0.953
15	25	8.474	0.729
20	25	8.452	0.707
25	25	8.174	0.429

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.746	0.412	0.0686	1.469	1.469	0.000	0.718
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.366	1.075	26.863	25.978	0.139	0.0720	-1.093	

Sample No. 2-21-97-21, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.232	1.01
5	0	6.757	0.54
10	0	6.471	0.25
15	0	6.922	0.70
20	0	7.432	1.21
25	0	7.775	1.55
0	5	6.691	0.47
5	5	6.743	0.52
10	5	6.601	0.38
15	5	6.759	0.54
20	5	6.744	0.52
25	5	6.583	0.36
0	10	6.884	0.66
5	10	7.049	0.83
10	10	7.156	0.94
15	10	7.353	1.13
20	10	7.666	1.45
25	10	6.677	0.46
0	15	7.225	1.00
5	15	7.067	0.85
10	15	6.801	0.58
15	15	6.883	0.66
20	15	6.221	0.00
25	15	6.647	0.43
0	20	6.949	0.73
5	20	7.428	1.21
10	20	6.650	0.43
15	20	6.926	0.71
20	20	6.309	0.09
25	20	6.634	0.41
0	25	7.425	1.20
5	25	7.468	1.25
10	25	6.746	0.53
15	25	6.883	0.66
20	25	7.136	0.92
25	25	6.895	0.67

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.718	0.365	0.0608	1.550	1.550	0.000	0.660
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.465	0.970	25.850	23.213	0.123	0.410	-0.201	

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Sample No. 3-21-97-1, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.196	0.950
5	0	7.758	1.512
10	0	7.695	1.449
15	0	7.062	0.816
20	0	7.487	1.241
25	0	7.399	1.153
0	5	7.236	0.990
5	5	7.390	1.144
10	5	7.331	1.085
15	5	6.950	0.704
20	5	6.841	0.595
25	5	7.438	1.192
0	10	7.009	0.763
5	10	7.058	0.812
10	10	7.087	0.841
15	10	7.368	1.122
20	10	6.705	0.459
25	10	7.283	1.037
0	15	7.371	1.125
5	15	6.796	0.550
10	15	6.246	0.000
15	15	7.062	0.816
20	15	7.463	1.217
25	15	7.302	1.056
0	20	7.618	1.372
5	20	7.679	1.433
10	20	7.324	1.078
15	20	6.965	0.719
20	20	7.346	1.100
25	20	7.242	0.996
0	25	7.640	1.394
5	25	7.078	0.832
10	25	7.516	1.270
15	25	7.372	1.126
20	25	7.793	1.547
25	25	7.485	1.239

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.020	0.323	0.0539	1.547	1.547	0.000	1.082
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.816	1.228	36.735	0.109	-0.866	1.501		

Sample No. 3-21-97-2, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.035	0.000
5	0	6.580	0.545
10	0	7.170	1.135
15	0	7.739	1.704
20	0	7.075	1.040
25	0	7.972	1.937
0	5	7.017	0.982
5	5	7.138	1.103
10	5	7.167	1.132
15	5	7.037	1.002
20	5	7.716	1.681
25	5	7.335	1.300
0	10	6.181	0.146
5	10	6.372	0.337
10	10	6.729	0.694
15	10	7.263	1.228
20	10	7.779	1.744
25	10	7.781	1.746
0	15	7.560	1.525
5	15	7.811	1.776
10	15	7.002	0.967
15	15	7.532	1.497
20	15	7.489	1.454
25	15	7.264	1.229
0	20	7.134	1.099
5	20	6.713	0.678
10	20	6.956	0.921
15	20	7.761	1.726
20	20	7.908	1.873
25	20	7.396	1.361
0	25	7.231	1.196
5	25	7.039	1.004
10	25	7.214	1.179
15	25	7.170	1.135
20	25	7.197	1.162
25	25	6.899	0.864

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.169	0.467	0.0778	1.937	1.937	0.000	1.148
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.974	1.511	42.102	56.868	0.158	-0.539	0.262	

Sample No. 3-21-97-3, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.108	0.331
5	0	7.127	0.350
10	0	7.474	0.697
15	0	7.719	0.942
20	0	7.451	0.674
25	0	7.124	0.347
0	5	6.777	0.000
5	5	7.044	0.267
10	5	7.660	0.883
15	5	7.645	0.868
20	5	7.415	0.638
25	5	7.400	0.623
0	10	7.165	0.388
5	10	7.082	0.305
10	10	7.170	0.393
15	10	7.606	0.829
20	10	7.562	0.785
25	10	7.421	0.644
0	15	7.669	0.892
5	15	7.313	0.536
10	15	7.065	0.288
15	15	7.493	0.716
20	15	7.255	0.478
25	15	7.205	0.428
0	20	8.355	1.578
5	20	8.095	1.318
10	20	7.843	1.066
15	20	7.493	0.716
20	20	7.337	0.560
25	20	7.723	0.946
0	25	7.048	0.271
5	25	7.747	0.970
10	25	8.421	1.644
15	25	8.094	1.317
20	25	7.799	1.022
25	25	7.566	0.789

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.708	0.375	0.0625	1.644	1.644	0.000	0.686
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.391	0.917	25.499	22.989	0.127	0.658	0.356	

Sample No. 3-21-97-4, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.919	0.191
5	0	7.717	0.989
10	0	7.100	0.372
15	0	7.353	0.625
20	0	6.728	0.000
25	0	7.061	0.333
0	5	6.851	0.123
5	5	8.145	1.417
10	5	7.822	1.094
15	5	7.368	0.640
20	5	7.125	0.397
25	5	7.308	0.580
0	10	7.499	0.771
5	10	7.799	1.071
10	10	7.673	0.945
15	10	7.160	0.432
20	10	6.852	0.124
25	10	6.854	0.126
0	15	7.502	0.774
5	15	7.282	0.554
10	15	6.975	0.247
15	15	7.025	0.297
20	15	7.499	0.771
25	15	7.024	0.296
0	20	7.752	1.024
5	20	7.256	0.528
10	20	7.527	0.799
15	20	7.465	0.737
20	20	7.491	0.763
25	20	7.547	0.819
0	25	7.375	0.647
5	25	7.175	0.447
10	25	7.361	0.633
15	25	7.653	0.925
20	25	7.673	0.945
25	25	7.561	0.833

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.619	0.330	0.0550	1.417	1.417	0.000	0.637
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.353	0.826	22.269	17.591	0.112	0.0900	-0.427	

Sample No. 3-21-97-5, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.262	1.109
5	0	8.003	1.850
10	0	8.005	1.852
15	0	6.686	0.533
20	0	6.153	0.000
25	0	6.681	0.528
0	5	7.250	1.097
5	5	7.172	1.019
10	5	8.334	2.181
15	5	8.661	2.508
20	5	7.975	1.822
25	5	7.497	1.344
0	10	7.124	0.971
5	10	6.864	0.711
10	10	8.086	1.933
15	10	9.222	3.069
20	10	9.482	3.329
25	10	8.115	1.962
0	15	6.844	0.691
5	15	6.833	0.680
10	15	7.762	1.609
15	15	7.745	1.592
20	15	8.733	2.580
25	15	8.213	2.060
0	20	7.222	1.069
5	20	6.565	0.412
10	20	7.553	1.400
15	20	7.524	1.371
20	20	9.047	2.894
25	20	8.461	2.308
0	25	7.475	1.322
5	25	7.365	1.212
10	25	7.295	1.142
15	25	7.794	1.641
20	25	8.484	2.331
25	25	8.156	2.003

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.559	0.784	0.131	3.329	3.329	0.000	1.496
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
1.044	2.032	56.135	109.072	0.265	0.285	-0.318	

Sample No. 3-21-97-6, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	7.993	1.295
5	0	7.006	0.308
10	0	6.822	0.124
15	0	6.799	0.101
20	0	6.971	0.273
25	0	6.831	0.133
0	5	7.254	0.556
5	5	7.571	0.873
10	5	7.507	0.809
15	5	7.465	0.767
20	5	7.414	0.716
25	5	6.930	0.232
0	10	7.007	0.309
5	10	6.929	0.231
10	10	7.223	0.525
15	10	7.124	0.426
20	10	7.262	0.564
25	10	7.085	0.387
0	15	7.234	0.536
5	15	7.045	0.347
10	15	7.244	0.546
15	15	7.104	0.406
20	15	6.947	0.249
25	15	7.560	0.862
0	20	7.282	0.584
5	20	7.559	0.861
10	20	7.237	0.539
15	20	7.077	0.379
20	20	6.913	0.215
25	20	7.139	0.441
0	25	6.947	0.249
5	25	7.194	0.496
10	25	7.300	0.602
15	25	7.161	0.463
20	25	7.319	0.621
25	25	6.698	0.000

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.473	0.267	0.0445	1.295	1.295	0.000	0.452
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.261	0.593	17.025	10.547	0.0904	0.789	1.192	

Sample No. 3-21-97-7, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.664	1.541
5	0	7.307	1.184
10	0	6.859	0.736
15	0	6.926	0.803
20	0	6.776	0.653
25	0	7.239	1.116
0	5	8.066	1.943
5	5	7.751	1.628
10	5	6.216	0.093
15	5	6.123	0.000
20	5	6.861	0.738
25	5	6.636	0.513
0	10	7.420	1.297
5	10	7.217	1.094
10	10	7.693	1.570
15	10	6.981	0.858
20	10	6.297	0.174
25	10	6.457	0.334
0	15	6.948	0.825
5	15	7.310	1.187
10	15	7.158	1.035
15	15	8.047	1.924
20	15	7.294	1.171
25	15	7.521	1.398
0	20	6.974	0.851
5	20	7.306	1.183
10	20	7.602	1.479
15	20	7.301	1.178
20	20	7.292	1.169
25	20	7.650	1.527
0	25	6.978	0.855
5	25	7.523	1.400
10	25	7.803	1.680
15	25	7.784	1.661
20	25	7.492	1.369
25	25	6.998	0.875

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.084	0.486	0.0809	1.943	1.943	0.000	1.170
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.814	1.440	39.042	50.596	0.164	-0.428	-0.166	

Sample No. 3-21-97-8, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	5.757	0.324
5	0	5.433	0.000
10	0	6.176	0.743
15	0	7.506	2.073
20	0	6.391	0.958
25	0	7.107	1.674
0	5	7.321	1.888
5	5	5.479	0.046
10	5	6.215	0.782
15	5	6.293	0.860
20	5	7.109	1.676
25	5	7.035	1.602
0	10	5.895	0.462
5	10	6.641	1.208
10	10	6.593	1.160
15	10	7.173	1.740
20	10	7.070	1.637
25	10	7.083	1.650
0	15	6.429	0.996
5	15	7.215	1.782
10	15	7.308	1.875
15	15	7.828	2.395
20	15	7.228	1.795
25	15	7.410	1.977
0	20	7.143	1.710
5	20	6.305	0.872
10	20	7.120	1.687
15	20	7.002	1.569
20	20	7.415	1.982
25	20	6.464	1.031
0	25	7.458	2.025
5	25	6.020	0.587
10	25	6.244	0.811
15	25	6.354	0.921
20	25	7.184	1.751
25	25	7.107	1.674

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.331	0.609	0.101	2.395	2.395	0.000	1.619
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.866	1.767	47.923	76.768	0.206	-0.537	-0.603	

Sample No. 3-21-97-9, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.143	1.281
5	0	6.388	0.526
10	0	6.331	0.469
15	0	6.403	0.541
20	0	6.686	0.824
25	0	6.794	0.932
0	5	7.292	1.430
5	5	7.231	1.369
10	5	6.318	0.456
15	5	6.553	0.691
20	5	6.236	0.374
25	5	7.295	1.433
0	10	7.592	1.730
5	10	7.049	1.187
10	10	6.862	1.000
15	10	6.579	0.717
20	10	6.537	0.675
25	10	6.768	0.906
0	15	7.441	1.579
5	15	7.463	1.601
10	15	6.778	0.916
15	15	7.245	1.383
20	15	5.862	0.000
25	15	6.731	0.869
0	20	7.853	1.991
5	20	7.400	1.538
10	20	7.378	1.516
15	20	6.621	0.759
20	20	6.468	0.606
25	20	6.332	0.470
0	25	7.376	1.514
5	25	8.075	2.213
10	25	7.890	2.028
15	25	7.131	1.269
20	25	7.849	1.987
25	25	7.241	1.379

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.116	0.542	0.0904	2.213	2.213	0.000	1.094
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.683	1.515	40.159	55.086	0.183	0.134	-0.730	

Sample No. 3-21-97-10, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.476	1.357
5	0	7.019	0.900
10	0	6.567	0.448
15	0	6.517	0.398
20	0	6.119	0.000
25	0	7.310	1.191
0	5	7.813	1.694
5	5	7.634	1.515
10	5	7.037	0.918
15	5	7.349	1.230
20	5	7.292	1.173
25	5	7.666	1.547
0	10	7.669	1.550
5	10	7.824	1.705
10	10	7.359	1.240
15	10	7.434	1.315
20	10	7.822	1.703
25	10	7.377	1.258
0	15	7.657	1.538
5	15	7.542	1.423
10	15	7.240	1.121
15	15	7.428	1.309
20	15	7.599	1.480
25	15	6.869	0.750
0	20	7.562	1.443
5	20	7.508	1.389
10	20	7.371	1.252
15	20	7.616	1.497
20	20	7.015	0.896
25	20	6.531	0.412
0	25	6.982	0.863
5	25	6.678	0.559
10	25	8.287	2.168
15	25	7.108	0.989
20	25	6.306	0.187
25	25	7.172	1.053

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.152	0.472	0.0786	2.168	2.168	0.000	1.246
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.898	1.489	41.471	55.563	0.160	-0.585	0.242	

Sample No. 3-21-97-11, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	Corrected Height (cm)
0	0	6.262	0.483
5	0	5.943	0.164
10	0	6.079	0.300
15	0	5.978	0.199
20	0	6.973	1.194
25	0	7.097	1.318
0	5	6.162	0.383
5	5	6.407	0.628
10	5	6.713	0.934
15	5	6.424	0.645
20	5	6.802	1.023
25	5	7.113	1.334
0	10	5.779	0.000
5	10	6.828	1.049
10	10	6.639	0.860
15	10	6.455	0.676
20	10	6.933	1.154
25	10	7.301	1.522
0	15	5.868	0.089
5	15	6.812	1.033
10	15	7.335	1.556
15	15	6.721	0.942
20	15	6.387	0.608
25	15	6.837	1.058
0	20	7.360	1.581
5	20	6.823	1.044
10	20	6.837	1.058
15	20	7.244	1.465
20	20	7.956	2.177
25	20	7.722	1.943
0	25	6.532	0.753
5	25	7.349	1.570
10	25	7.605	1.826
15	25	7.788	2.009
20	25	7.570	1.791
25	25	6.773	0.994

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.038	0.566	0.0943	2.177	2.177	0.000	1.039
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.637	1.494	37.363	49.993	0.192	0.0628	-0.623	

Sample No. 3-21-97-12, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.507	1.700
5	0	7.315	1.508
10	0	7.559	1.752
15	0	6.761	0.954
20	0	5.807	0.000
25	0	6.740	0.933
0	5	6.727	0.920
5	5	6.825	1.018
10	5	6.073	0.266
15	5	6.621	0.814
20	5	6.942	1.135
25	5	5.868	0.061
0	10	5.901	0.094
5	10	6.754	0.947
10	10	7.124	1.317
15	10	7.224	1.417
20	10	7.142	1.335
25	10	6.720	0.913
0	15	7.453	1.646
5	15	7.366	1.559
10	15	7.614	1.807
15	15	7.878	2.071
20	15	7.651	1.844
25	15	7.102	1.295
0	20	7.365	1.558
5	20	7.021	1.214
10	20	8.007	2.200
15	20	7.836	2.029
20	20	7.848	2.041
25	20	7.266	1.459
0	25	6.822	1.015
5	25	7.120	1.313
10	25	7.015	1.208
15	25	7.739	1.932
20	25	7.688	1.881
25	25	7.203	1.396

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.293	0.569	0.0949	2.200	2.200	0.000	1.326
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.950	1.726	46.552	71.543	0.193	-0.683	0.155	

SITE 3

Sample No. 5-2-97-1, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.462	1.071
5	0	8.006	1.615
10	0	7.658	1.267
15	0	7.498	1.107
20	0	6.453	0.062
25	0	6.435	0.044
0	5	7.513	1.122
5	5	7.971	1.580
10	5	8.015	1.624
15	5	7.306	0.915
20	5	6.945	0.554
25	5	6.591	0.200
0	10	7.634	1.243
5	10	7.783	1.392
10	10	7.819	1.428
15	10	7.448	1.057
20	10	7.561	1.170
25	10	6.975	0.584
0	15	7.640	1.249
5	15	7.500	1.109
10	15	7.464	1.073
15	15	7.612	1.221
20	15	7.761	1.370
25	15	8.107	1.716
0	20	6.653	0.262
5	20	7.214	0.823
10	20	7.560	1.169
15	20	7.923	1.532
20	20	7.812	1.421
25	20	8.029	1.638
0	25	6.391	0.000
5	25	6.908	0.517
10	25	7.274	0.883
15	25	7.704	1.313
20	25	7.594	1.203
25	25	7.584	1.193

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.048	0.479	0.0799	1.716	1.716	0.000	1.170
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.853	1.381	37.727	47.575	0.162	-0.886	-0.0587	

Sample No. 5-2-97-2, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	8.043	4.842
5	0	7.768	4.567
10	0	6.397	3.196
15	0	6.216	3.015
20	0	4.850	1.649
25	0	3.201	0.000
0	5	7.667	4.466
5	5	7.342	4.141
10	5	7.576	4.375
15	5	7.375	4.174
20	5	7.073	3.872
25	5	5.411	2.210
0	10	7.419	4.218
5	10	7.923	4.722
10	10	7.576	4.375
15	10	7.780	4.579
20	10	7.692	4.491
25	10	7.532	4.331
0	15	7.431	4.230
5	15	7.505	4.304
10	15	7.771	4.570
15	15	7.587	4.386
20	15	7.355	4.154
25	15	7.345	4.144
0	20	7.291	4.090
5	20	7.450	4.249
10	20	7.264	4.063
15	20	7.115	3.914
20	20	6.828	3.627
25	20	6.805	3.604
0	25	7.472	4.271
5	25	7.909	4.708
10	25	7.364	4.163
15	25	6.865	3.664
20	25	6.659	3.458
25	25	6.533	3.332

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	3.893	0.945	0.158	4.842	4.842	0.000	4.168
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
3.646	4.380	140.154	576.925	0.320	-2.590	8.062	

Sample No. 5-2-97-3, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	5.327	0.757
5	0	4.570	0.000
10	0	4.733	0.163
15	0	4.848	0.278
20	0	4.784	0.214
25	0	7.368	2.798
0	5	5.993	1.423
5	5	6.309	1.739
10	5	6.334	1.764
15	5	5.863	1.293
20	5	5.258	0.688
25	5	5.256	0.686
0	10	6.652	2.082
5	10	6.694	2.124
10	10	6.010	1.440
15	10	5.958	1.388
20	10	5.682	1.112
25	10	5.912	1.342
0	15	6.916	2.346
5	15	6.503	1.933
10	15	6.018	1.448
15	15	6.226	1.656
20	15	5.909	1.339
25	15	6.138	1.568
0	20	6.400	1.830
5	20	6.188	1.618
10	20	6.333	1.763
15	20	6.300	1.730
20	20	6.389	1.819
25	20	6.732	2.162
0	25	6.906	2.336
5	25	7.132	2.562
10	25	6.990	2.420
15	25	6.957	2.387
20	25	6.899	2.329
25	25	6.859	2.289

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.578	0.720	0.120	2.798	2.798	0.000	1.693
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
1.316	2.143	56.826	107.832	0.244	-0.609	-0.248	

Sample No. 5-2-97-4, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.529	1.884
5	0	7.125	1.480
10	0	6.991	1.346
15	0	7.284	1.639
20	0	6.950	1.305
25	0	7.141	1.496
0	5	7.198	1.553
5	5	7.236	1.591
10	5	7.407	1.762
15	5	7.463	1.818
20	5	7.347	1.702
25	5	7.238	1.593
0	10	6.226	0.581
5	10	7.171	1.526
10	10	7.226	1.581
15	10	7.468	1.823
20	10	7.374	1.729
25	10	7.444	1.799
0	15	5.645	0.000
5	15	6.904	1.259
10	15	7.657	2.012
15	15	7.547	1.902
20	15	7.700	2.055
25	15	7.185	1.540
0	20	6.437	0.792
5	20	6.519	0.874
10	20	7.660	2.015
15	20	7.493	1.848
20	20	7.231	1.586
25	20	6.775	1.130
0	25	7.282	1.637
5	25	6.963	1.318
10	25	6.985	1.340
15	25	7.262	1.617
20	25	7.116	1.471
25	25	7.030	1.385

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.500	0.418	0.0697	2.055	2.055	0.000	1.583
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
1.343	1.781	53.989	87.095	0.142	-1.688	3.959	

Sample No. 5-2-97-5, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.133	0.056
5	0	6.671	0.594
10	0	6.926	0.849
15	0	6.248	0.171
20	0	6.143	0.066
25	0	6.077	0.000
0	5	6.941	0.864
5	5	7.163	1.086
10	5	7.353	1.276
15	5	7.654	1.577
20	5	7.484	1.407
25	5	6.934	0.857
0	10	7.172	1.095
5	10	7.887	1.810
10	10	7.633	1.556
15	10	7.783	1.706
20	10	7.154	1.077
25	10	6.559	0.482
0	15	7.123	1.046
5	15	7.260	1.183
10	15	7.833	1.756
15	15	7.668	1.591
20	15	7.501	1.424
25	15	6.932	0.855
0	20	7.045	0.968
5	20	7.608	1.531
10	20	7.644	1.567
15	20	7.887	1.810
20	20	7.282	1.205
25	20	7.081	1.004
0	25	7.310	1.233
5	25	7.429	1.352
10	25	7.544	1.467
15	25	7.563	1.486
20	25	7.102	1.025
25	25	6.866	0.789

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.106	0.500	0.0833	1.810	1.810	0.000	1.139
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.856	1.509	39.821	52.786	0.169	-0.746	-0.0224	

Sample No. 5-2-97-6, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	7.027	1.651
5	0	6.399	1.023
10	0	5.841	0.465
15	0	5.602	0.226
20	0	5.516	0.140
25	0	5.618	0.242
0	5	6.611	1.235
5	5	5.376	0.000
10	5	5.662	0.286
15	5	5.904	0.528
20	5	5.695	0.319
25	5	5.456	0.080
0	10	5.834	0.458
5	10	6.642	1.266
10	10	5.640	0.264
15	10	5.581	0.205
20	10	5.574	0.198
25	10	5.864	0.488
0	15	6.883	1.507
5	15	6.760	1.384
10	15	6.674	1.298
15	15	5.882	0.506
20	15	6.679	1.303
25	15	5.622	0.246
0	20	6.864	1.488
5	20	7.004	1.628
10	20	6.693	1.317
15	20	6.867	1.491
20	20	6.958	1.582
25	20	6.728	1.352
0	25	6.907	1.531
5	25	6.579	1.203
10	25	7.065	1.689
15	25	6.682	1.306
20	25	7.003	1.627
25	25	6.846	1.470

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.917	0.592	0.0986	1.689	1.689	0.000	1.219
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.275	1.479	33.002	42.509	0.200	-0.184	-1.756	

Sample No. 5-2-97-7, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.746	2.561
5	0	6.405	2.220
10	0	6.353	2.168
15	0	6.057	1.872
20	0	6.168	1.983
25	0	6.690	2.505
0	5	6.453	2.268
5	5	6.559	2.374
10	5	6.486	2.301
15	5	6.391	2.206
20	5	4.405	0.220
25	5	6.836	2.651
0	10	6.262	2.077
5	10	6.446	2.261
10	10	6.581	2.396
15	10	6.518	2.333
20	10	6.069	1.884
25	10	7.150	2.965
0	15	6.441	2.256
5	15	6.859	2.674
10	15	7.014	2.829
15	15	6.894	2.709
20	15	7.253	3.068
25	15	7.287	3.102
0	20	5.722	1.537
5	20	6.829	2.644
10	20	6.911	2.726
15	20	6.815	2.630
20	20	7.347	3.162
25	20	6.953	2.768
0	25	4.185	0.000
5	25	4.879	0.694
10	25	6.108	1.923
15	25	5.793	1.608
20	25	6.904	2.719
25	25	7.160	2.975

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	2.257	0.725	0.121	3.162	3.162	0.000	2.354
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
2.030	2.714	81.269	201.853	0.245	-1.676	3.141	

Sample No. 5-2-97-8, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.846	0.961
5	0	6.482	0.597
10	0	6.636	0.751
15	0	6.727	0.842
20	0	6.926	1.041
25	0	7.498	1.613
0	5	6.920	1.035
5	5	7.121	1.236
10	5	7.105	1.220
15	5	6.930	1.045
20	5	7.117	1.232
25	5	6.995	1.110
0	10	7.137	1.252
5	10	7.313	1.428
10	10	7.175	1.290
15	10	6.874	0.989
20	10	6.833	0.948
25	10	6.737	0.852
0	15	6.810	0.925
5	15	6.981	1.096
10	15	6.892	1.007
15	15	7.313	1.428
20	15	7.265	1.380
25	15	6.861	0.976
0	20	6.395	0.510
5	20	6.683	0.798
10	20	6.982	1.097
15	20	7.337	1.452
20	20	7.580	1.695
25	20	7.330	1.445
0	25	5.885	0.000
5	25	6.341	0.456
10	25	6.843	0.958
15	25	6.782	0.897
20	25	7.085	1.200
25	25	7.451	1.566

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	1.065	0.346	0.0577	1.695	1.695	0.000	1.043
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.911	1.271	38.328	45.001	0.117	-0.709	1.429	

Sample No. 5-2-97-9, Frame area 1024 cm^2			
x coord. (cm)	y coord. (cm)	z coord. (cm)	corrected height (cm)
0	0	6.465	0.220
5	0	6.646	0.401
10	0	7.297	1.052
15	0	6.617	0.372
20	0	6.581	0.336
25	0	7.048	0.803
0	5	7.448	1.203
5	5	7.417	1.172
10	5	6.997	0.752
15	5	6.294	0.049
20	5	6.687	0.442
25	5	6.245	0.000
0	10	7.295	1.050
5	10	6.650	0.405
10	10	6.652	0.407
15	10	6.645	0.400
20	10	6.747	0.502
25	10	7.191	0.946
0	15	6.531	0.286
5	15	6.697	0.452
10	15	6.744	0.499
15	15	6.944	0.699
20	15	6.598	0.353
25	15	6.618	0.373
0	20	6.610	0.365
5	20	6.925	0.680
10	20	6.651	0.406
15	20	6.378	0.133
20	20	7.179	0.934
25	20	6.640	0.395
0	25	6.343	0.098
5	25	6.474	0.229
10	25	6.823	0.578
15	25	7.247	1.002
20	25	7.637	1.392
25	25	7.338	1.093

Topographic variation statistical analysis:							
n	Mean	Std. Dev.	Std. Error	Range	Maximum	Minimum	Median
36	0.569	0.359	0.0598	1.392	1.392	0.000	0.424
25%	75%	Sum	Sum of Squares	Confidence	Skewness	Kurtosis	
0.359	0.869	20.479	16.162	0.121	0.596	-0.567	

Appendix D: Analytical Data from Clay Membrane Experiment.

UNM NMIMT DOE LANL SANDIA NMSU

HOWE Laboratory

5317 Lovington Highway 505-392-5603 ext. 633 Hobbs, NM 88240

New Mexico Junior College

The Effect of a Clay Layer on the Migration of Gasoline Through Soil

A Report for Mike Whitworth

of

Bureau of Mines
Socorro, NM

Report Prepared by:

Dr. Douglas Strong
Howe Laboratory
New Mexico Junior College
Hobbs, New Mexico

September 29, 1997

Report

OBSERVATIONS

Mike, the GC-MS spits out a lot of information. The chromatograms, data etc. that I refer to in this report are located, in order of mention (hopefully), at the back of the report. Basically, we will deal with total ion chromatograms (TIC) and extracted ion chromatograms.

All of the samples were gas-chromatographed into a Hewlett-Packard 5971A quadrupole mass spectrometer, set to scan 33 through 450 atomic mass units at approximately 1.2 scans/second. From each of the approximately 3600 scans generated during a 60 minute run, the abundance value for a particular mass (actually for a particular mass/charge ratio or m/e), for instance m/e 57, corresponding to a four-carbon hydrocarbon fragment, with formula C_4H_9, which could be a butyl, iso-butyl, or tertiary-butyl fragment, can be extracted and plotted as a function of time to give an extracted ion chromatogram which will show a peak for all of the eluting species which produce a butyl fragment when bombarded by the electron beam in the source of the mass spectrometer. In the total ion chromatograms, the abundances which result for each mass value of a scan are summed so that each scan has one total ion abundance value. This total abundance value for each scan is plotted against time to give the total ion chromatograms.

Sample identifications and run numbers are given on pages ID-1 through ID-10 at the end of the report. As examples of runs, the total ion chromatogram for the stock gasoline sample is shown in Chromatogram 1 and the extracted ion chromatogram for mass 57 is shown in chromatogram 2 for the same sample. The extracted ion chromatogram is spread out over pages A-2 through A7, in order to see the chromatographic detail. The peaks found in the extracted ion chromatogram, along with retention times and peak areas are listed in the integration report, pages A-8 and A-9.

A library search of these peaks, using the scan obtained at the apex of each peak, is shown on pages A-10 through A-15. Pages A-16 through A-21 shown the library search for the same 61 peaks using scans obtained by subtracting the scan at the start of the peak from the scan at the peak apex. This is meant to subtract background and other interferences. I find it useful to search the mass spectral database using both of these schemes.

The library search (apex minus start of peak) resulting from the total ion chromatogram (not shown) of sample Gas 2-7 is shown on pages A-22 through A-32. The 116 peaks found

by the integrator can be compared with the 61 peaks found by integrating the mass 57 extracted ion chromatogram. The difference in the number of peaks found arises mainly from the aromatic content of the gasoline. The aromatics (containing a benzene ring) do not give a significant mass 57 fragment unless they are substituted by alkyl moeities with a total of 4 carbons or more. The mass spectrum of an alkyl-substituted benzene is usually dominated by the mass 91 fragment, resulting from the relatively stable cyclic aromatic seven-carbon tropylium cation. Benzene itself gives a fairly strong abundance at mass 78, which is its atomic weight.

With your samples, I produced extracted ion chromatograms of the mass 57 and mass 91 ions, effectively separating the sample into an alkanes (including the branched alkanes) fraction and an aromatics fraction. Each extracted ion chromatogram was then integrated and the individual peak areas summed to give a total area indicative of the amount of that fraction in the sample.

I was disappointed with this quantitative approach. The extracted ion chromatograms for all your samples, in sequence beginning with gas 2, the stock gasoline, are shown on pages A-33 through A-60. For each group of three samples, the extracted ion chromatograms for mass 57 appear first, followed by the extracted ion chromatograms for mass 91. The chromatograms are shown 3 per page and all to the same scale to facilitate visual comparison.

Gas 2-4, because it gave variable results for two previous runs, was run three more times, twice in succession, and once again after the machine had completed five runs for other samples. These chromatograms are shown on pages A-61 through A-67. Page A-68 compares the total ion chromatograms for the cell solution and the stock gasoline.

The total integrations for mass 57 and mass 91 are shown on pages A-69 through A-74, except for sample Gas 2-4, which was later run in triplicate. Unfortunately, due to a hard disk snafu and loss of data, these three runs, visually displayed previously, could not be integrated.

To examine the aromatic fraction of each sample more closely, the peak by peak integrations for mass 91 for each sample are given on pages A-75 through A-85. The identity of each component can be obtained by matching the retention times of the components with the retention times shown in the total ion chromatogram library search of sample Gas 2-5, shown on pages A-86 through A-94. The more abundant aromatic compounds are highlighted with a star in the library search. Total ion chromatograms for the gasoline stock and a methanol blank are shown on page A-95.

CONCLUSIONS

The total area integrations for alkane and aromatic fractions show a variability of about 10% from sample to sample. Visual inspections of the extracted ion chromatograms indicate to me that, on a component-by-component basis, all samples have essentially the same makeup. There were a few weak injections which gave lower summed areas overall, but the relationships between the components, the percent composition by component, remained unchanged. I see no fractionation of the gasoline stock in any subsequent samples.

But you don't need me. I've tried to include enough raw data that you can make your own decisions.

SEQUENCE 1 : RUNGAS

DATAFILE HEADERS FROM C:\HPCHEM\1\DATA\RUNGAS

```
Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0101001.D
Sample Name    : GAS2 STOCK(1day old) DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 13 Jun 97   4:15 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4829
Start Time     : 5.729
End Time       : 58.995
Vial Number    : 1
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Sample Name    : GAS2 STOCK (fresh) DF40 MeOH
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 13 Jun 97   5:34 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4836
Start Time     : 5.727
End Time       : 58.998
Vial Number    : 2
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0301003.D
Sample Name    : GAS2-2, 6/7/97  DF40 MeOH Bi-Ph 32/10
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 13 Jun 97   6:46 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4833
Start Time     : 5.727
End Time       : 58.995
Vial Number    : 3
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Sample Name    : GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 13 Jun 97   7:58 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4835
Start Time     : 5.727
End Time       : 59.005
```

Vial Number : 4

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0501005.D
Sample Name : GAS2-4, 6/8/97 DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 13 Jun 97 9:12 pm
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4836
Start Time : 5.727
End Time : 59.004
Vial Number : 5

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0601006.D
Sample Name : GAS2-5, DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 13 Jun 97 10:24 pm
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4832
Start Time : 5.727
End Time : 59.005
Vial Number : 6

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0701007.D
Sample Name : GAS2-6, DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 13 Jun 97 11:37 pm
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4835
Start Time : 5.727
End Time : 58.999
Vial Number : 7

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0801008.D
Sample Name : GAS2-7, DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 14 Jun 97 12:50 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4831
Start Time : 5.727

End Time : 58.996
Vial Number : 8

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0901009.D
Sample Name : GAS2-8, 6/9/97 DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 14 Jun 97 2:02 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4832
Start Time : 5.727
End Time : 58.999
Vial Number : 9

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1001010.D
Sample Name : GAS2-9, 6/10/97 DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 14 Jun 97 3:14 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4832
Start Time : 5.727
End Time : 59.000
Vial Number : 10

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Sample Name : GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 14 Jun 97 4:27 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4832
Start Time : 5.727
End Time : 59.004
Vial Number : 11

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1201012.D
Sample Name : GAS2-11, Cell Soln. DF40 MeOH 0.5uL
Misc. Info. : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator :
Date injected : 14 Jun 97 5:39 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 4837

Start Reruns beginning with Sample GAS2-5.

```
Start Time      : 5.727
End Time        : 58.998
Vial Number     : 12
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0601013.D
Sample Name    : GAS2-5, DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97   6:51 am
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4832
Start Time     : 5.727
End Time       : 59.001
Vial Number    : 6
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0701014.D
Sample Name    : GAS2-6, DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97   8:04 am
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4832
Start Time     : 5.727
End Time       : 58.996
Vial Number    : 7
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Sample Name    : GAS2-7, DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97   9:17 am
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4832
Start Time     : 5.727
End Time       : 59.001
Vial Number    : 8
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\0901016.D
Sample Name    : GAS2-8, 6/9/97 DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97  10:29 am
Instrument     : 5971 - In
Method used    : SCAN
```

```
No of spectra  : 4832
Start Time     : 5.727
End Time       : 58.997
Vial Number    : 9
-------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1001017.D
Sample Name    : GAS2-9, 6/10/97 DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97  11:42 am
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4833
Start Time     : 5.727
End Time       : 58.999
Vial Number    : 10
-------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1101018.D
Sample Name    : GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97  12:54 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4832
Start Time     : 5.727
End Time       : 59.001
Vial Number    : 11
-------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1201019.D
Sample Name    : GAS2-11, Cell Soln. DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97   2:06 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 4837
Start Time     : 5.727
End Time       : 58.997
Vial Number    : 12
-------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Sample Name    : MeOH Blank 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       :
Date injected  : 14 Jun 97   3:18 pm
Instrument     : 5971 - In
```

SEQUENCE 2 : RUNGAS2

\Data\Rungas2 100

DATAFILE HEADERS FROM C:\HPCHEM\1\DATA\RUNGAS2

```
Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0101001.D
Sample Name    : GAS2 STOCK(1day old) DF40 MeOH 0.5uL
Misc. Info.    : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   3:04 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5161
Start Time     : 2.544
End Time       : 58.995
Vial Number    : 1
---------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0201002.D
Sample Name    : GAS2 STOCK (fresh) DF40 MeOH
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   4:13 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5360
Start Time     : 0.409
End Time       : 59.003
Vial Number    : 2
---------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0301003.D
Sample Name    : GAS2-2, 6/7/97  DF40 MeOH Bi-Ph 32/10
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   5:22 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5162
Start Time     : 2.544
End Time       : 59.005
Vial Number    : 3
---------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0401004.D
Sample Name    : GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   6:32 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5161
Start Time     : 2.544
End Time       : 59.001
```

```
Vial Number    : 4
------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0501005.D
Sample Name    : GAS2-4, 6/8/97 DF40 MeOH 0.5uL
Misc. Info.    : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   7:41 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5162
Start Time     : 2.544
End Time       : 58.999
Vial Number    : 5
------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0502006.D
Sample Name    : GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc. Info.    : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   8:50 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5166
Start Time     : 2.544
End Time       : 58.997
Vial Number    : 5
------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0601007.D
Sample Name    : GAS2-5, DF40 MeOH 1uL
Misc. Info.    : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97   9:59 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5161
Start Time     : 2.544
End Time       : 59.003
Vial Number    : 6
------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0701008.D
Sample Name    : GAS2-6, DF40 MeOH 1uL
Misc. Info.    : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator       : dls
Date injected  : 20 Jun 97  11:08 pm
Instrument     : 5971 - In
Method used    : SCAN
No of spectra  : 5169
Start Time     : 2.544
```

End Time : 58.999
Vial Number : 7

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0801009.D
Sample Name : GAS2-7, DF40 MeOH 1uL
Misc. Info. : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator : dls
Date injected : 21 Jun 97 12:17 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 5160
Start Time : 2.544
End Time : 58.999
Vial Number : 8

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0901010.D
Sample Name : GAS2-8, 6/9/97 DF40 MeOH 1uL
Misc. Info. : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator : dls
Date injected : 21 Jun 97 1:27 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 5163
Start Time : 2.544
End Time : 58.999
Vial Number : 9

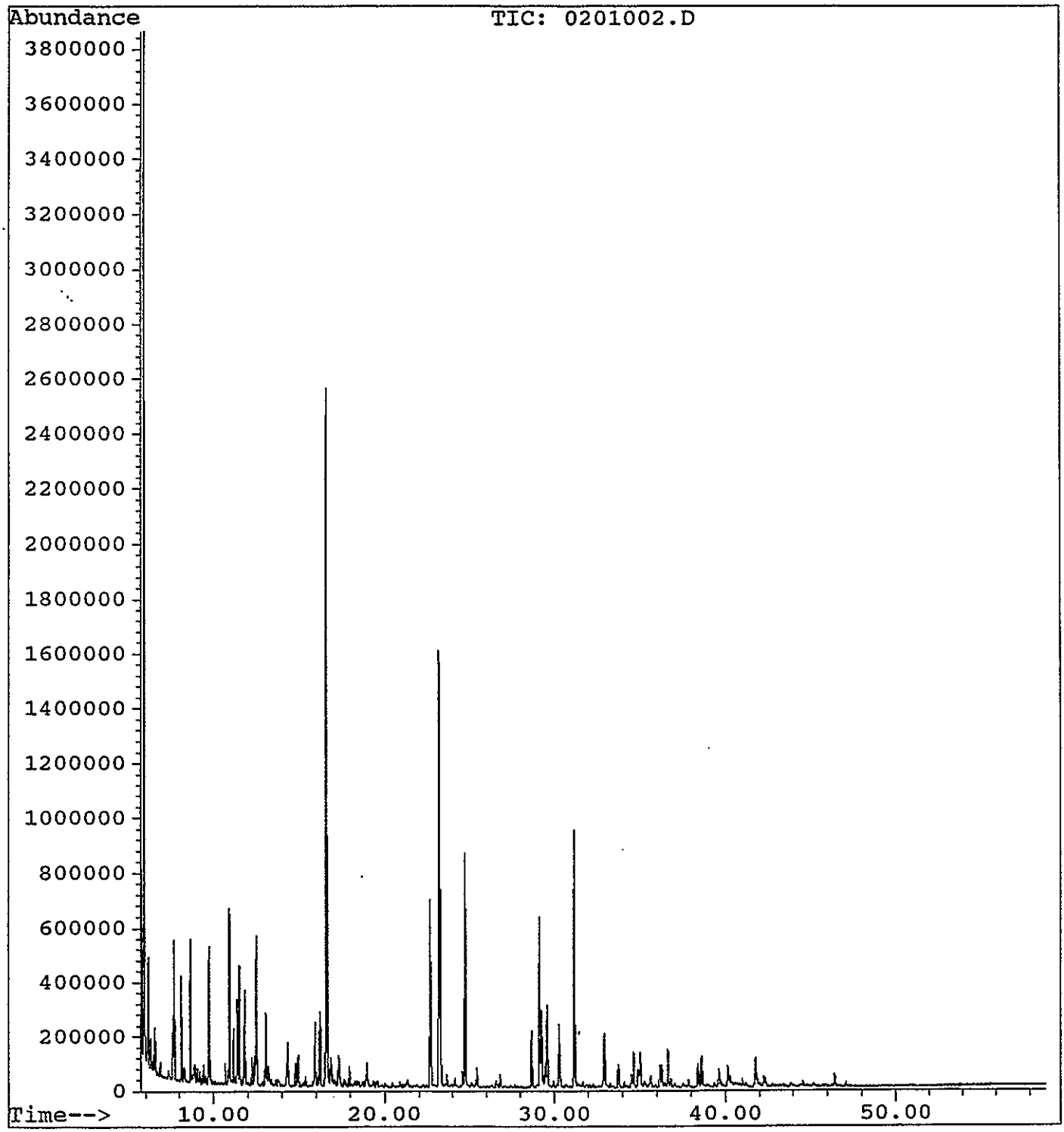
Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\1001011.D
Sample Name : GAS2-9, 6/10/97 DF40 MeOH 1uL
Misc. Info. : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator : dls
Date injected : 21 Jun 97 2:37 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 5160
Start Time : 2.544
End Time : 58.997
Vial Number : 10

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Sample Name : GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc. Info. : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator : dls
Date injected : 21 Jun 97 3:46 am
Instrument : 5971 - In
Method used : SCAN
No of spectra : 5161

```
Start Time      : 2.544
End Time        : 59.005
Vial Number     : 5
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\1101013.D
Sample Name     : GAS2-10, DF40 MeOH Bi-Ph 19/28 1uL
Misc. Info.     : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator        : dls
Date injected   : 21 Jun 97   4:55 am
Instrument      : 5971 - In
Method used     : SCAN
No of spectra   : 5160
Start Time      : 2.544
End Time        : 58.995
Vial Number     : 11
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\1201014.D
Sample Name     : GAS2-11, Cell Soln. DF40 MeOH 1uL
Misc. Info.     : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Operator        : dls
Date injected   : 21 Jun 97   6:05 am
Instrument      : 5971 - In
Method used     : SCAN
No of spectra   : 5166
Start Time      : 2.544
End Time        : 59.004
Vial Number     : 12
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0201015.D
Sample Name     : GAS2 STOCK (fresh) DF40 MeOH
Misc. Info.     : H18 S45 inj250ms270 37Init3/130-5/220 1uL
Operator        : dls
Date injected   : 21 Jun 97   7:14 am
Instrument      : 5971 - In
Method used     : SCAN
No of spectra   : 5161
Start Time      : 2.544
End Time        : 58.999
Vial Number     : 2
-----------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\0101016.D
Sample Name     : GAS2 STOCK(1day old) DF40 MeOH 0.5uL
Misc. Info.     : H18 S45 inj250ms270 37Init3/130-5/220 1uL
Operator        : dls
Date injected   : 21 Jun 97   8:24 am
Instrument      : 5971 - In
Method used     : SCAN
```

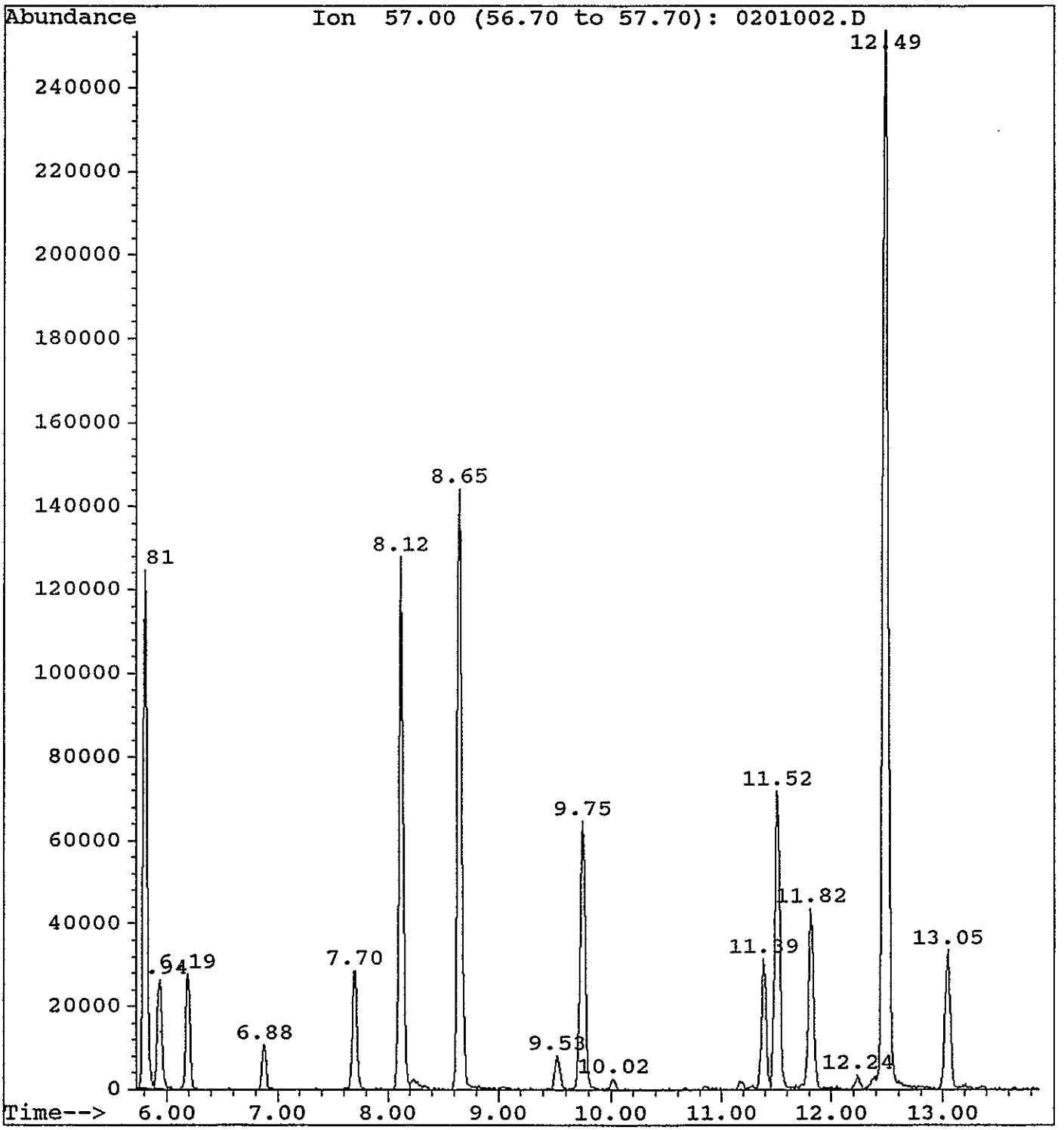
```
No of spectra   : 5161
Start Time      : 2.544
End Time        : 59.005
Vial Number     : 1
-------------------------------------------------------------

Data file Name : C:\HPCHEM\1\DATA\RUNGAS2\BLANK2.D
Sample Name    : MeOH Blank
Misc. Info.    : H18 S45 inj250ms270 37Init7/250 .5uL
Operator       : dls
Date injected  : 21 Jun 97  12:30 pm
Instrument     : 5971 - In
Method used    : SCAN2
No of spectra  : 3208
Start Time     : 13.045
End Time       : 48.425
Vial Number    : 15
-------------------------------------------------------------
```

File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



Chromatogram 1

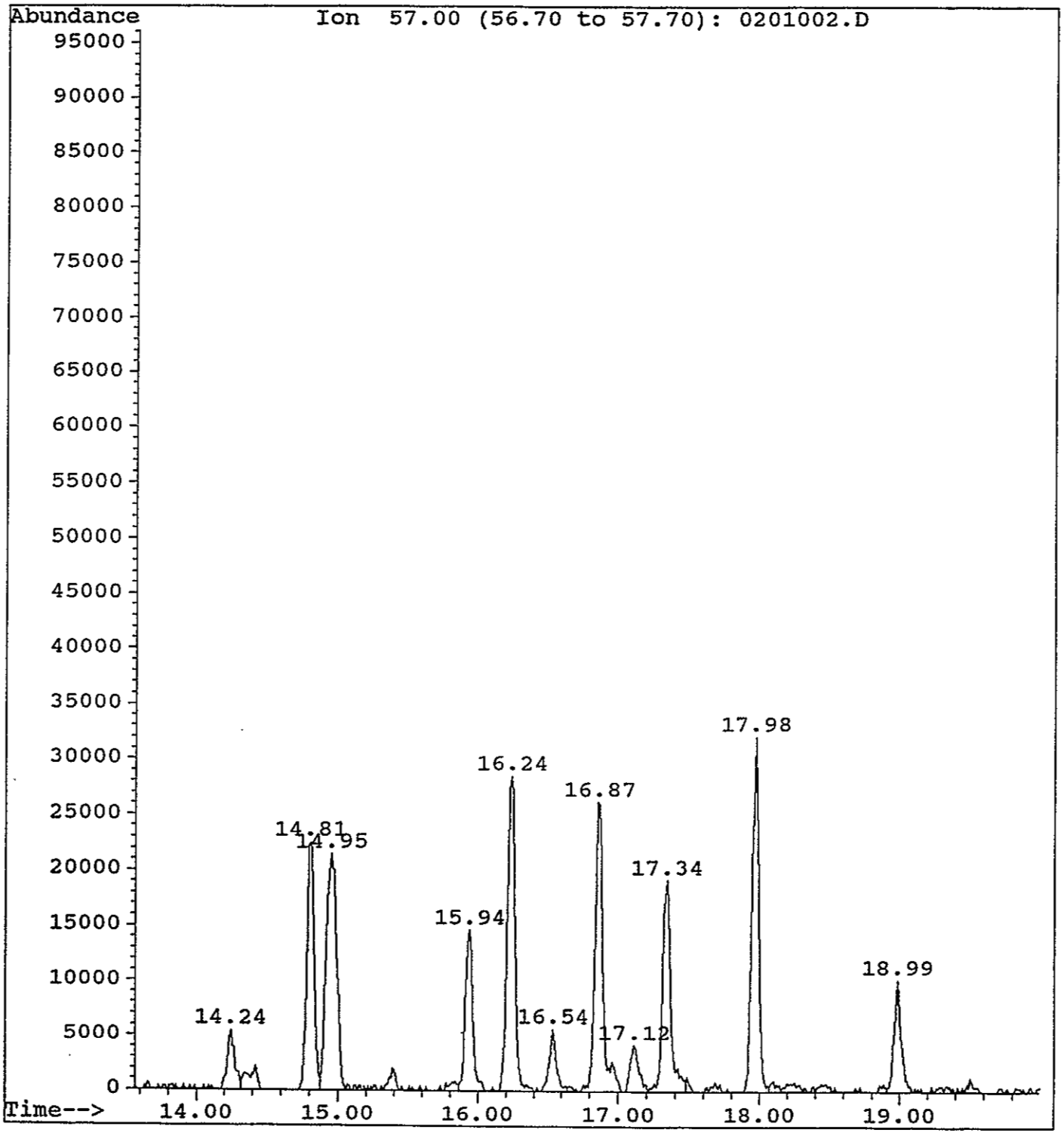
File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



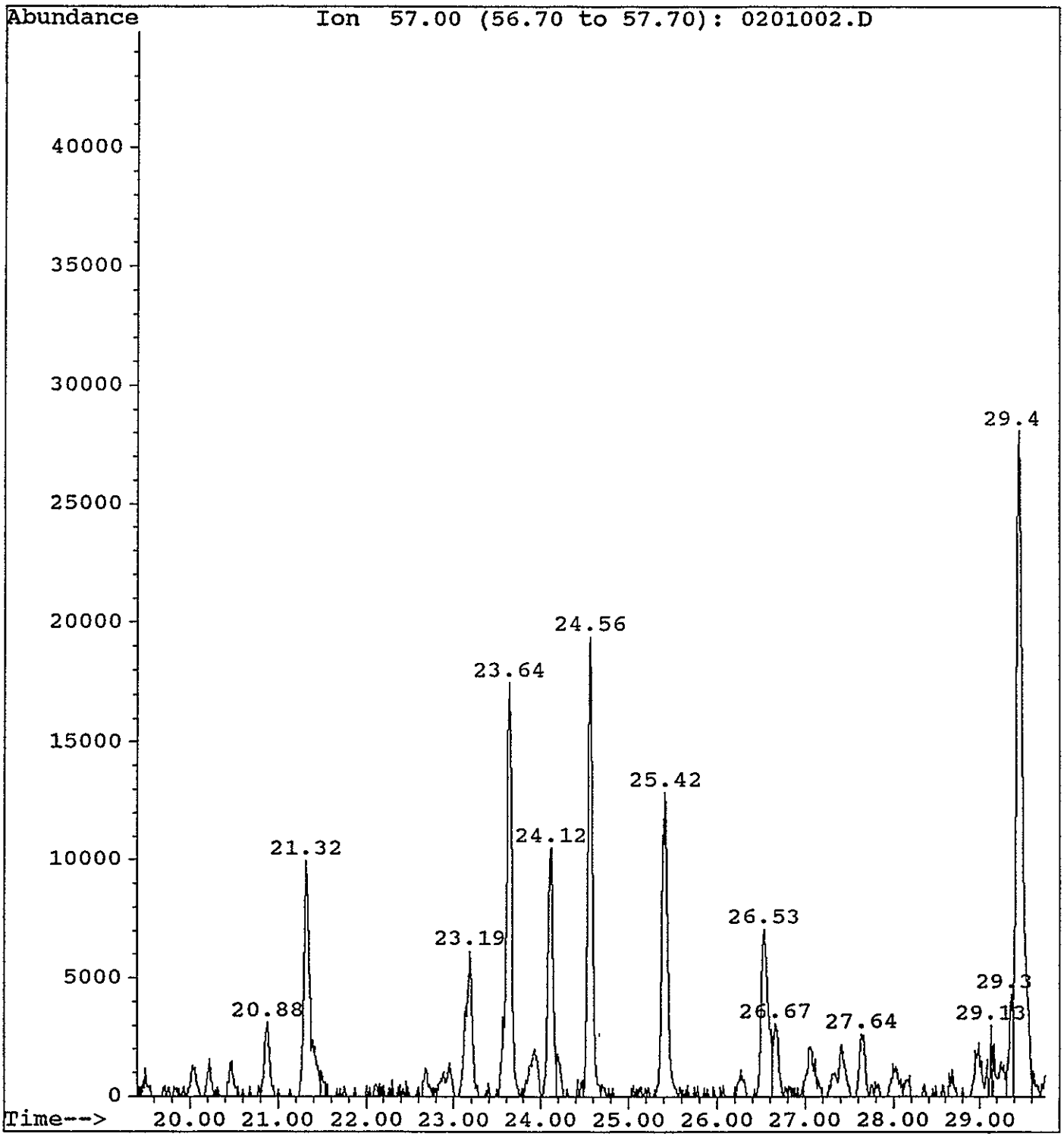
Chromatogram 2

A-2

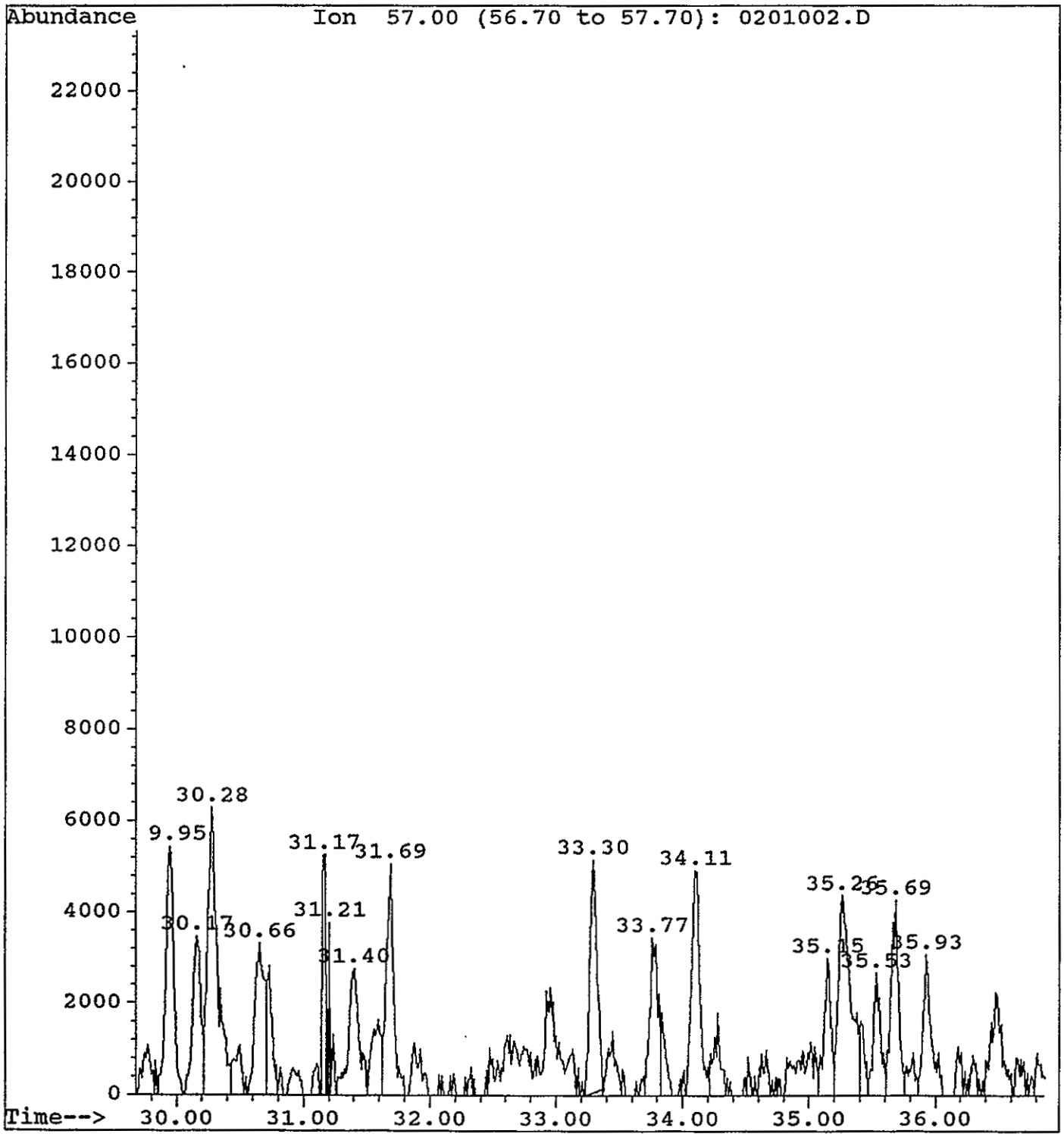
File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



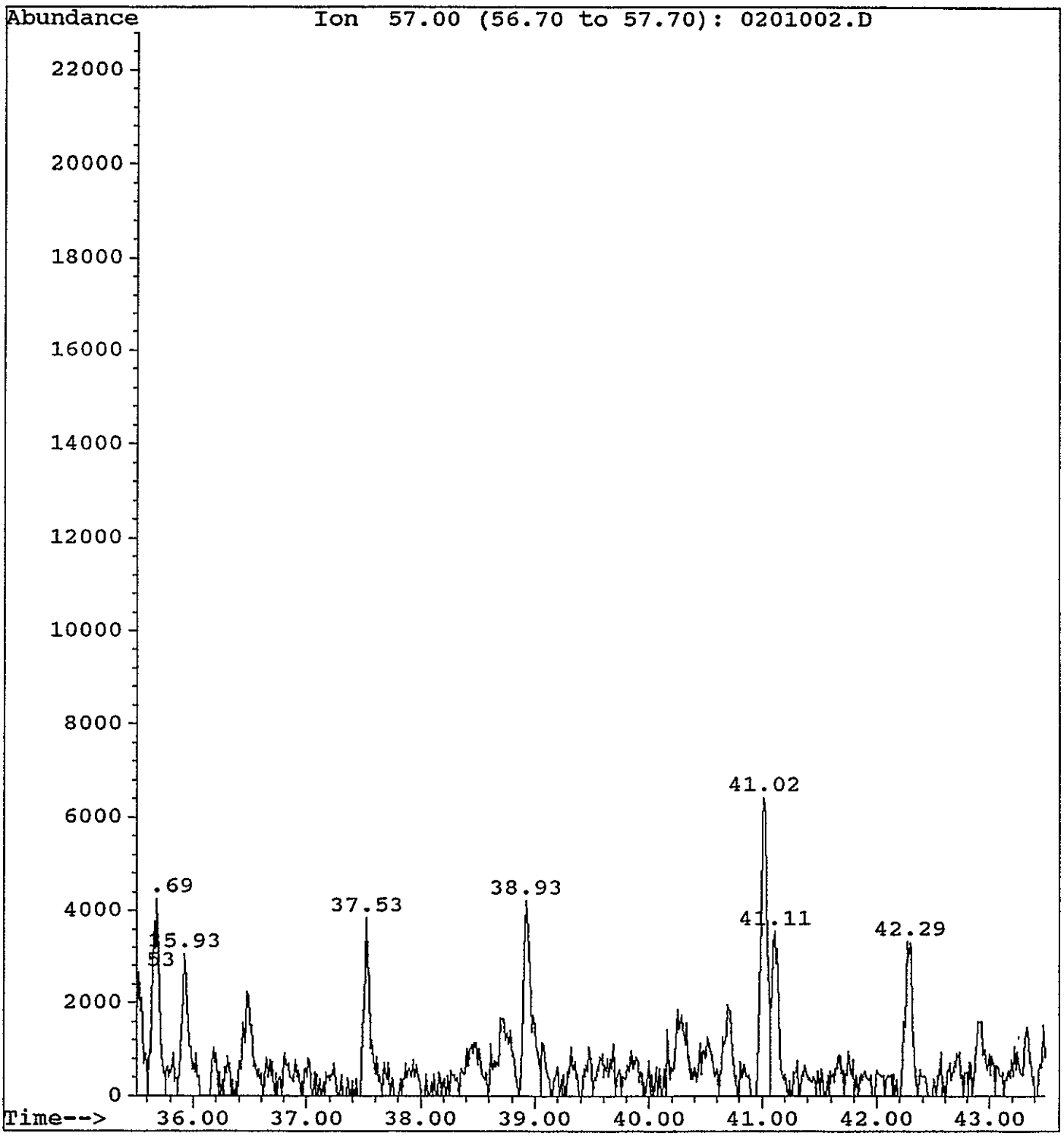
File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



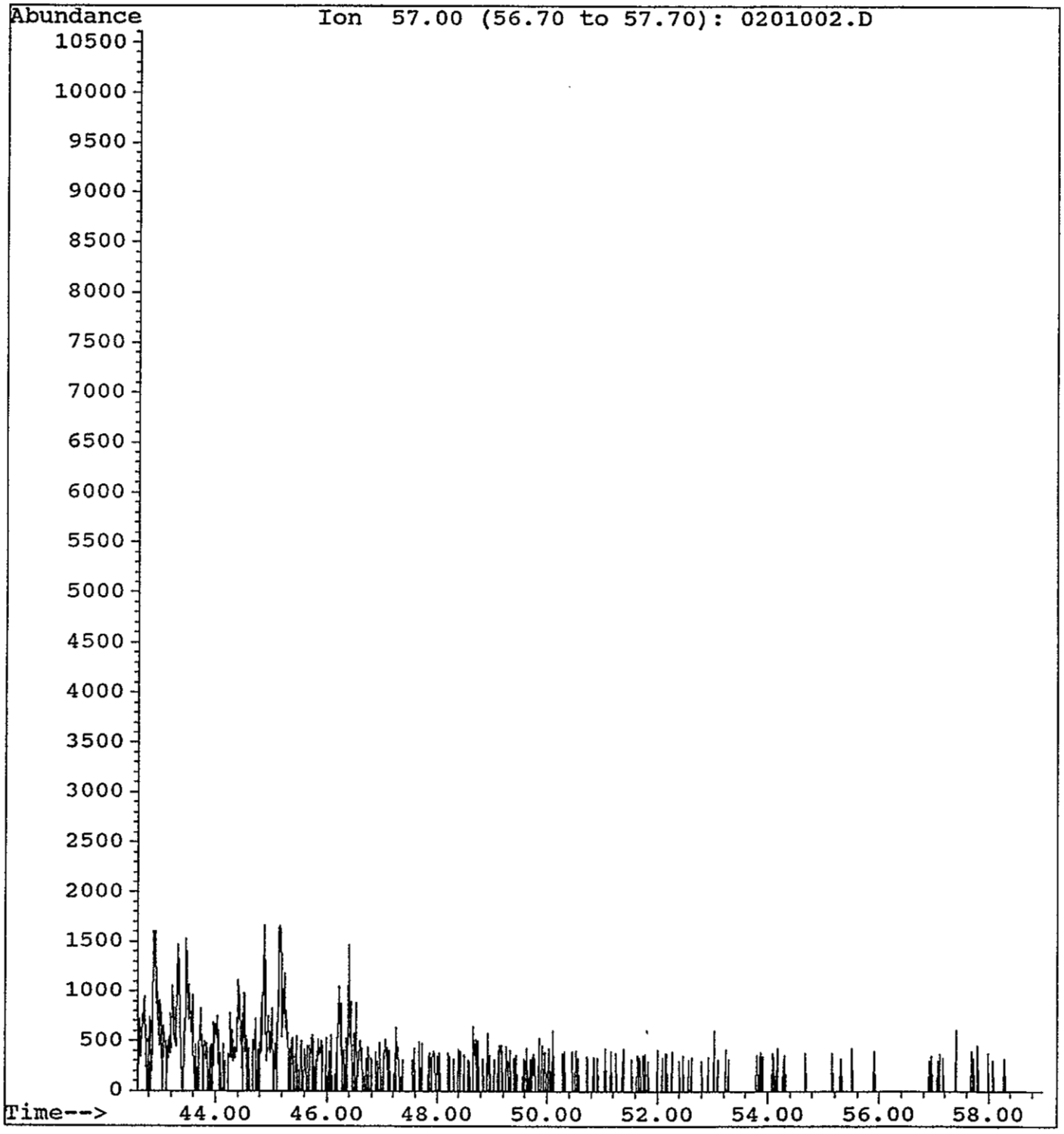
File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2



Ion 57.00 (56.70 to 57.70): 0201002.D
GAS2 STOCK (fresh) DF40 MeOH

112

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	5.812	BV	0.039	3048256	5.745	5.888
2	5.940	VB	0.052	813191	5.888	6.057
3	6.192	BB	0.042	736315	6.085	6.296
4	6.882	BB	0.046	296901	6.746	6.976
5	7.700	VB	0.043	794554	7.639	7.802
6	8.123	BV	0.043	3444361	7.967	8.199
7	8.654	BV	0.045	4056213	8.528	8.810
8	9.529	BV	0.053	273226	9.391	9.619
9	9.754	PV	0.053	2115185	9.619	9.910
10	10.024	PV	0.052	82402	9.948	10.089
11	11.392	VV	0.050	939656	11.317	11.451
12	11.515	VV	0.053	2400546	11.451	11.669
13	11.822	VV	0.051	1397622	11.705	11.919
14	12.241	PV	0.053	103692	12.160	12.300
15	12.488	PV	0.054	8904508	12.300	12.724
16	13.051	VV	0.055	1143039	12.909	13.139
17	14.244	BV	0.051	194107	14.139	14.316
18	14.806	BV	0.055	798548	14.662	14.876
19	14.954	VV	0.077	1103615	14.876	15.060
20	15.943	VV	0.061	540620	15.864	16.067
21	16.242	PV	0.062	1118905	16.067	16.450
22	16.542	PV	0.051	190295	16.450	16.636
23	16.867	VV	0.058	1027341	16.694	17.031
24	17.117	PV	0.061	178191	17.031	17.216
25	17.344	VV	0.063	772158	17.216	17.474
26	17.976	BV	0.056	1074893	17.803	18.071
27	18.987	VV	0.051	353800	18.910	19.171
28	20.882	VV	0.064	125228	20.807	20.971
29	21.320	BV	0.071	486254	21.035	21.476
30	23.192	BB	0.072	314211	23.046	23.294
31	23.641	PV	0.066	750310	23.512	23.793
32	24.118	PV	0.062	418734	24.015	24.178
33	24.564	PV	0.058	758595	24.440	24.796
34	25.418	BV	0.061	567965	25.278	25.564
35	26.535	PV	0.079	386549	26.445	26.628
36	26.666	VV	0.063	129970	26.628	26.753
37	27.641	BV	0.073	115455	27.565	27.723
38	29.129	PV	0.020	33310	29.108	29.147
39	29.367	VV	0.043	106233	29.308	29.379
40	29.455	VV	0.080	1489999	29.379	29.695
41	29.954	VV	0.068	236424	29.854	30.062
42	30.166	PV	0.069	150098	30.062	30.214
43	30.284	VV	0.076	350111	30.214	30.430
44	30.658	PV	0.086	168774	30.564	30.710
45	31.168	PV	0.031	100387	31.133	31.193
46	31.210	PV	0.023	42591	31.193	31.266
47	31.402	VV	0.085	162889	31.266	31.508
48	31.693	VV	0.073	204152	31.624	31.816
49	33.299	PV	0.057	201166	33.228	33.380
50	33.767	PV	0.079	159038	33.659	33.831
51	34.108	VV	0.067	225591	34.030	34.212
52	35.153	VV	0.054	111850	35.077	35.200
53	35.263	VV	0.089	288131	35.200	35.398
54	35.534	VV	0.065	104559	35.472	35.609
55	35.690	VV	0.061	175403	35.609	35.757
56	35.933	VB	0.063	136866	35.867	36.068

57	37.528	PV	0.054	147044	37.460	37.658	113
58	38.929	PV	0.071	205467	38.864	39.049	
59	41.018	BV	0.058	251883	40.936	41.076	
60	41.113	VV	0.057	148811	41.076	41.232	
61	42.295	PV	0.069	149638	42.195	42.360	

Information from Data File:
File : C:\HPCHEM\1\DATA\EVALDEMO.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 1

Search Libraries: C:\DATABASE\NBS75K.L Minimum Quality: 0

Unknown Spectrum: Apex
Integration Params: eventall.e

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
1	5.81	6.44	C:\DATABASE\NBS75K.L			
			Butane, 2-methyl-	62518	000078-78-4	68
			Butane, 2-methyl-	62517	000078-78-4	59
			Butane, 2-methyl-	281	000078-78-4	53
2	5.94	1.72	C:\DATABASE\NBS75K.L			
			Acetone	62325	000067-64-1	80
			Acetone	62324	000067-64-1	80
			Acetone	62327	000067-64-1	78
3	6.19	1.56	C:\DATABASE\NBS75K.L			
			Pentane	62516	000109-66-0	64
			Pentane	62515	000109-66-0	64
			Pentane	280	000109-66-0	53
4	6.88	0.63	C:\DATABASE\NBS75K.L			
			Cyanic acid, ethyl ester	237	000627-48-5	9
			Acetic acid, hydroxy-	364	000079-14-1	9
			2-Propenamide	241	000079-06-1	5
5	7.70	1.68	C:\DATABASE\NBS75K.L			
			Pentane, 2-methyl-	62863	000107-83-5	90
			Pentane, 2-methyl-	62865	000107-83-5	87
			Pentane, 2-methyl-	733	000107-83-5	72
6	8.12	7.28	C:\DATABASE\NBS75K.L			
			Pentane, 3-methyl-	62867	000096-14-0	78
			Pentane, 3-methyl-	62868	000096-14-0	78
			1-Butanol, 2-methyl-	62949	000137-32-6	50
7	8.65	8.57	C:\DATABASE\NBS75K.L			
			Hexane	62874	000110-54-3	91
			Hexane	62872	000110-54-3	86
			Hexane	736	000110-54-3	78
8	9.53	0.58	C:\DATABASE\NBS75K.L			
			Cyclobutanone, oxime	622	002972-05-6	9
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	9
			Pentane, 2,2,3,4-tetramethyl-	5164	001186-53-4	9
9	9.75	4.47	C:\DATABASE\NBS75K.L			
			1-Pentanol, 4-methyl-	63577	000626-89-1	59
			Hexane, 3,4-dimethyl-	64210	000583-48-2	59
			Hexane, 3,4-dimethyl-	64211	000583-48-2	59

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
10	10.03	0.17	C:\DATABASE\NBS75K.L			
			2,2'-Bioxirane	667	001464-53-5	4
			Propanal, 3-ethoxy-	1703	002806-85-1	2
			Hydroperoxide, 1-methylpentyl	3531	024254-55-5	2
11	11.40	1.99	C:\DATABASE\NBS75K.L			
			Hexane, 1,1'-oxybis-	69124	000112-58-3	78
			Hexane, 2-methyl-	1598	000591-76-4	74
			Hexane, 1,1'-oxybis-	19535	000112-58-3	64
12	11.52	5.07	C:\DATABASE\NBS75K.L			
			Pentane, 2,3-dimethyl-	63430	000565-59-3	91
			Pentane, 2,3-dimethyl-	63431	000565-59-3	91
			Pentane, 2,3-dimethyl-	63432	000565-59-3	91
13	11.83	2.95	C:\DATABASE\NBS75K.L			
			Hexane, 3-methyl-	1593	000589-34-4	91
			Hexane, 3-methyl-	63421	000589-34-4	81
			Hexane, 3-methyl-	63423	000589-34-4	80
14	12.24	0.22	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-	1316	002453-00-1	64
			Heptanol	3359	053535-33-4	59
			Cyclopentane, 1,3-dimethyl-, cis-	1360	002532-58-3	50
15	12.49	18.82	C:\DATABASE\NBS75K.L			
			Hexane, 2,2-dimethyl-	64216	000590-73-8	78
			Pentane, 2,2,4-trimethyl-	64221	000540-84-1	74
			Butane, 2,2,3,3-tetramethyl-	64214	000594-82-1	64
16	13.05	2.42	C:\DATABASE\NBS75K.L			
			Heptane	63438	000142-82-5	91
			Heptane	63439	000142-82-5	87
			Hexane, 3-methyl-	63423	000589-34-4	40
17	14.24	0.41	C:\DATABASE\NBS75K.L			
			Cyclobutanone, 3,3-dimethyl-	1275	001192-33-2	25
			Cyclopentanamine, 1-methyl-	1412	040571-45-7	25
			Hexane, 3-ethyl-4-methyl-	5162	003074-77-9	12
18	14.80	1.69	C:\DATABASE\NBS75K.L			
			Hexane, 2,5-dimethyl-	64205	000592-13-2	94
			Hexane, 2,5-dimethyl-	64206	000592-13-2	81
			Hexane, 2,5-dimethyl-	64204	000592-13-2	76
19	14.96	2.33	C:\DATABASE\NBS75K.L			
			Hexane, 3,4-dimethyl-	3086	000583-48-2	50
			Butane, 2,2,3-trimethyl-	1599	000464-06-2	50
			Furan, tetrahydro-2,4-dimethyl-, c	1509	039168-01-9	47
20	15.94	1.14	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,4-trimethyl-	64228	000565-75-3	90
			Pentane, 2,3,4-trimethyl-	3100	000565-75-3	83
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	80

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
21	16.24	2.37	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,3-trimethyl-	3088	000560-21-4	72
			Heptane, 4-methyl-	3096	000589-53-7	59
			Hexane, 2,3,4-trimethyl-	5147	000921-47-1	59
22	16.55	0.40	C:\DATABASE\NBS75K.L			
			Hexane, 2,3-dimethyl-	3097	000584-94-1	74
			Hexane, 2,3-dimethyl-	64226	000584-94-1	64
			Heptane, 4-methyl-	3096	000589-53-7	43
23	16.87	2.17	C:\DATABASE\NBS75K.L			
			Heptane, 2-methyl-	64219	000592-27-8	91
			Heptane, 2-methyl-	64218	000592-27-8	87
			Hexane, 2,5-dimethyl-	64206	000592-13-2	76
24	17.12	0.38	C:\DATABASE\NBS75K.L			
			Octane	64207	000111-65-9	27
			Hexane, 2-methyl-	1598	000591-76-4	12
			Octane	3084	000111-65-9	12
25	17.34	1.63	C:\DATABASE\NBS75K.L			
			Heptane, 3-methyl-	64227	000589-81-1	87
			Hexane, 2,3,3-trimethyl-	65104	016747-28-7	53
			Hexane, 2-methyl-	1598	000591-76-4	53
26	17.98	2.27	C:\DATABASE\NBS75K.L			
			Hexane, 2,2,5-trimethyl-	65129	003522-94-9	83
			Hexane, 2,2,5-trimethyl-	65128	003522-94-9	72
			Hexane, 2,2,5-trimethyl-	65127	003522-94-9	59
27	18.98	0.75	C:\DATABASE\NBS75K.L			
			Heptane, 2,4-dimethyl-	5145	002213-23-2	64
			Hexane, 2,4-dimethyl-	64213	000589-43-5	53
			Hexane, 1-(hexyloxy)-2-methyl-	23019	074421-17-3	50
28	20.88	0.26	C:\DATABASE\NBS75K.L			
			Hydroxylamine, O-decyl-	15973	029812-79-1	37
			3-Ethyl-3-methylheptane	8110	017302-01-1	35
			4-Octanone	65061	000589-63-9	35
29	21.32	1.03	C:\DATABASE\NBS75K.L			
			Heptane, 2,5-dimethyl-	5143	002216-30-0	59
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	40
			Heptane, 3-ethyl-	5141	015869-80-4	38
30	23.19	0.66	C:\DATABASE\NBS75K.L			
			Benzene, 1,3-dimethyl-	63696	000108-38-3	95
			Benzene, 1,2-dimethyl-	63707	000095-47-6	94
			Benzene, 1,3-dimethyl-	63695	000108-38-3	94
31	23.65	1.59	C:\DATABASE\NBS75K.L			
			Octane, 3-methyl-	5150	002216-33-3	76
			Octane, 3-methyl-	65130	002216-33-3	64
			Heptane, 2,5-dimethyl-	5143	002216-30-0	52

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
32	24.12	0.89	C:\DATABASE\NBS75K.L			
			Pentane, 2,2,3,4-tetramethyl-	5164	001186-53-4	50
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	47
			2,2,6,6-Tetramethylheptane	11610	040117-45-1	47
33	24.56	1.60	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,3,4,6,6-hexamethyl-	19044	062108-32-1	53
			Hexane, 2,2,5,5-tetramethyl-	66226	001071-81-4	53
			2,2,6,6-Tetramethylheptane	11610	040117-45-1	47
34	25.42	1.20	C:\DATABASE\NBS75K.L			
			Dodecane, 2,6,11-trimethyl-	25998	031295-56-4	47
			Tetradecane	69661	000629-59-4	46
			Octadecane	71559	000593-45-3	43
35	26.53	0.82	C:\DATABASE\NBS75K.L			
			Nonane, 4-methyl-	66223	017301-94-9	32
			Decane, 2,5-dimethyl-	15368	017312-50-4	23
			Heptane, 3-ethyl-	5141	015869-80-4	23
36	26.67	0.27	C:\DATABASE\NBS75K.L			
			4,4-Dimethylcyclooctene	7023	000000-00-0	12
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	12
			Nitrous acid, cyclohexyl ester	5216	005156-40-1	10
37	27.65	0.24	C:\DATABASE\NBS75K.L			
			Octane, 1,1'-oxybis-	71251	000629-82-3	38
			Octane, 2,6-dimethyl-	66228	002051-30-1	37
			Octane, 1,1'-oxybis-	71250	000629-82-3	35
38	29.13	0.07	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	95
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	94
			Benzene, 1-ethyl-3-methyl-	3769	000620-14-4	91
39	29.36	0.22	C:\DATABASE\NBS75K.L			
			Nonane, 4-methyl-	8099	017301-94-9	43
			Pentane, 2,2,3,3-tetramethyl-	65115	007154-79-2	38
			Nonane, 4-methyl-	66223	017301-94-9	38
40	29.45	3.15	C:\DATABASE\NBS75K.L			
			Octane, 2,5,6-trimethyl-	11607	062016-14-2	72
			Undecane, 3-methyl-	15362	001002-43-3	64
			2,2,7,7-Tetramethyloctane	15365	001071-31-4	59
41	29.96	0.50	C:\DATABASE\NBS75K.L			
			Heptadecane, 2,6-dimethyl-	37466	054105-67-8	59
			Nonane, 3-methyl-	66203	005911-04-6	47
			Octane, 2,3,7-trimethyl-	11603	062016-34-6	47
42	30.17	0.32	C:\DATABASE\NBS75K.L			
			2,2,6,6-Tetramethylheptane	11610	040117-45-1	23
			1-Butanol, 2-methyl-	62945	000137-32-6	23
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	23

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
43	30.29	0.74	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	94
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	94
			Benzene, 1-ethyl-3-methyl-	64562	000620-14-4	94
44	30.65	0.36	C:\DATABASE\NBS75K.L			
			Ether, heptyl hexyl	23013	007289-40-9	38
			Hexane, 1-(hexyloxy)-5-methyl-	23021	074421-19-5	32
			1-Butanol, 4-butoxy-	8880	004161-24-4	9
45	31.17	0.21	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64570	000108-67-8	95
			Benzene, 1,3,5-trimethyl-	64571	000108-67-8	94
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	93
46	31.20	0.09	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64570	000108-67-8	95
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	94
			Benzene, 1,3,5-trimethyl-	64571	000108-67-8	94
47	31.40	0.34	C:\DATABASE\NBS75K.L			
			3-Ethyl-3-methylheptane	8110	017302-01-1	43
			Dodecane, 1-fluoro-	19931	000334-68-9	37
			1-Heptadecanamine	34975	004200-95-7	16
48	31.69	0.43	C:\DATABASE\NBS75K.L			
			Decane	66208	000124-18-5	74
			Tricosane	73318	000638-67-5	50
			Dotriacontane	74490	000544-85-4	50
49	33.30	0.43	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,4,6,6-pentamethyl-	68259	013475-82-6	40
			Heptane, 4-ethyl-2,2,6,6-tetrameth	19042	062108-31-0	25
			Pentane, 3-ethyl-2,2-dimethyl-	65110	016747-32-3	25
50	33.77	0.34	C:\DATABASE\NBS75K.L			
			Indane	64484	000496-11-7	93
			Benzene, 1-ethenyl-2-methyl-	64478	000611-15-4	72
			Benzene, cyclopropyl-	3592	000873-49-4	59
51	34.11	0.48	C:\DATABASE\NBS75K.L			
			Hexatriacontane	74636	000630-06-8	50
			Pentadecane	70278	000629-62-9	42
			Tetracosane	73543	000646-31-1	39
52	35.16	0.24	C:\DATABASE\NBS75K.L			
			Hexane, 3-ethyl-	3094	000619-99-8	32
			Heptane, 4-ethyl-	5148	002216-32-2	32
			3-Ethyl-3-methyl-2-pentanol	5503	000000-00-0	9
53	35.27	0.61	C:\DATABASE\NBS75K.L			
			1-Butanol, 4-butoxy-	8880	004161-24-4	37
			Octane, 2,6-dimethyl-	66227	002051-30-1	25
			Decane, 2,6,7-trimethyl-	19027	062108-25-2	23

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
54	35.53	0.22	C:\DATABASE\NBS75K.L			
			Octane, 1,1'-oxybis-	71250	000629-82-3	53
			Octane, 1,1'-oxybis-	71251	000629-82-3	50
			Octane, 1,1'-oxybis-	32426	000629-82-3	50
55	35.69	0.37	C:\DATABASE\NBS75K.L			
			Dodecane, 1-fluoro-	19931	000334-68-9	23
			Octane, 2,4,6-trimethyl-	11606	062016-37-9	22
			Benzene, (1-methylpropyl)-	65543	000135-98-8	14
56	35.94	0.29	C:\DATABASE\NBS75K.L			
			Hexatriacontane	74636	000630-06-8	50
			Decane, 3-methyl-	67315	013151-34-3	40
			Pentadecane	26001	000629-62-9	38
57	37.52	0.31	C:\DATABASE\NBS75K.L			
			Pentadecane	70278	000629-62-9	47
			Eicosane	72324	000112-95-8	47
			Tridecane	69019	000629-50-5	38
58	38.93	0.43	C:\DATABASE\NBS75K.L			
			2,2,7,7-Tetramethyloctane	15365	001071-31-4	32
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	23
			Octadecane, 2,2,4,15,17,17-hexamet	60724	055470-97-8	23
59	41.02	0.53	C:\DATABASE\NBS75K.L			
			Heptadecane, 2,6,10,15-tetramethyl	42196	054833-48-6	64
			Heptadecane, 2,6,10,14-tetramethyl	42200	018344-37-1	64
			Dodecane, 2,6,10-trimethyl-	70270	003891-98-3	64
60	41.11	0.31	C:\DATABASE\NBS75K.L			
			Hexane, 1-(hexyloxy)-5-methyl-	23021	074421-19-5	23
			1-Pentanol, 2-ethyl-4-methyl-	5549	000106-67-2	17
			1-Octanol, 2-butyl-	69110	003913-02-8	17
61	42.30	0.32	C:\DATABASE\NBS75K.L			
			Benzene, (1,1-dimethylethyl)methyl	9391	027138-21-2	53
			Benzene, 1,3-dimethyl-5-(1-methyle	9379	004706-90-5	43
			Benzene, 1,4-dimethyl-2-(1-methyle	9382	004132-72-3	43

Information from Data File:
File : C:\HPCHEM\1\DATA\EVALDEMO.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 1

Search Libraries: C:\DATABASE\NBS75K.L Minimum Quality: 0

Unknown Spectrum: Apex minus start of peak
Integration Params: eventall.e

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
1	5.81	6.44	C:\DATABASE\NBS75K.L			
			Butane, 2-methyl-	62518	000078-78-4	91
			Butane, 2-methyl-	281	000078-78-4	78
			Butane, 2-methyl-	62517	000078-78-4	50
2	5.94	1.72	C:\DATABASE\NBS75K.L			
			Acetone	62324	000067-64-1	80
			Acetone	62327	000067-64-1	72
			Acetone	62323	000067-64-1	72
3	6.19	1.56	C:\DATABASE\NBS75K.L			
			Pentane	62515	000109-66-0	78
			Pentane	62516	000109-66-0	72
			Pentane	280	000109-66-0	53
4	6.88	0.63	C:\DATABASE\NBS75K.L			
			Azetidine, 2-methyl-	245	019812-49-8	45
			2-Furanmethanol, tetrahydro-	63508	000097-99-4	40
			2-Furanol, tetrahydro-2-methyl-	63475	007326-46-7	33
5	7.70	1.68	C:\DATABASE\NBS75K.L			
			Pentane, 2-methyl-	733	000107-83-5	78
			Pentane, 2-methyl-	62865	000107-83-5	78
			Pentane, 2-methyl-	62864	000107-83-5	53
6	8.12	7.28	C:\DATABASE\NBS75K.L			
			Pentane, 3-methyl-	62868	000096-14-0	83
			Pentane, 3-methyl-	62867	000096-14-0	83
			Pentane, 3-ethyl-2,2-dimethyl-	65110	016747-32-3	47
7	8.65	8.57	C:\DATABASE\NBS75K.L			
			Hexane	62873	000110-54-3	91
			Hexane	62874	000110-54-3	91
			Hexane	62872	000110-54-3	86
8	9.53	0.58	C:\DATABASE\NBS75K.L			
			Borinic acid, diethyl-	685	004426-31-7	5
			Methane, isocyanato-	62311	000624-83-9	5
			Methane, isocyanato-	82	000624-83-9	5
9	9.75	4.47	C:\DATABASE\NBS75K.L			
			Hexane, 3,4-dimethyl-	64211	000583-48-2	64
			Hexane, 3,4-dimethyl-	64210	000583-48-2	64
			Pentane, 2,3-dimethyl-	63430	000565-59-3	50

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
10	10.03	0.17	C:\DATABASE\NBS75K.L			
			Methane, isocyanato-	82	000624-83-9	5
			Methane, isocyanato-	62311	000624-83-9	4
			Azetidine	83	000503-29-7	3
11	11.40	1.99	C:\DATABASE\NBS75K.L			
			Hexane, 2-methyl-	1598	000591-76-4	87
			Hexane, 1,1'-oxybis-	69124	000112-58-3	78
			Hexane, 1,1'-oxybis-	19535	000112-58-3	64
12	11.52	5.07	C:\DATABASE\NBS75K.L			
			Pentane, 2,3-dimethyl-	1597	000565-59-3	91
			Pentane, 2,3-dimethyl-	63430	000565-59-3	91
			Pentane, 2,3-dimethyl-	63432	000565-59-3	91
13	11.83	2.95	C:\DATABASE\NBS75K.L			
			Hexane, 3-methyl-	1593	000589-34-4	91
			Hexane, 3-methyl-	63421	000589-34-4	87
			Hexane, 3-methyl-	63422	000589-34-4	87
14	12.24	0.22	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-	1316	002453-00-1	78
			Cyclopentane, 1,3-dimethyl-, cis-	1360	002532-58-3	53
			Cyclopentane, 1,3-dimethyl-, trans	1329	001759-58-6	52
15	12.49	18.82	C:\DATABASE\NBS75K.L			
			Hexane, 2,2-dimethyl-	64216	000590-73-8	72
			Pentane, 2,2,4-trimethyl-	64221	000540-84-1	64
			Butane, 2,2,3,3-tetramethyl-	64214	000594-82-1	64
16	13.05	2.42	C:\DATABASE\NBS75K.L			
			Heptane	63438	000142-82-5	91
			Hexane, 3-methyl-	63422	000589-34-4	47
			3-Hexanone	63357	000589-38-8	43
17	14.24	0.41	C:\DATABASE\NBS75K.L			
			Cyclobutanone, 3,3-dimethyl-	1275	001192-33-2	47
			2-Hexene, 5-methyl-, (E)-	1357	007385-82-2	47
			1-Butanol, 2-methyl-	62948	000137-32-6	45
18	14.80	1.69	C:\DATABASE\NBS75K.L			
			Hexane, 2,5-dimethyl-	64205	000592-13-2	94
			Hexane, 2,5-dimethyl-	64204	000592-13-2	90
			Hexane, 2,5-dimethyl-	64206	000592-13-2	81
19	14.96	2.33	C:\DATABASE\NBS75K.L			
			Oxetane, 2-ethyl-3-methyl-	1566	053778-62-4	59
			Hexane, 3,4-dimethyl-	64210	000583-48-2	52
			Furan, tetrahydro-2,4-dimethyl-, c	1509	039168-01-9	50
20	15.94	1.14	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	91
			Pentane, 2,3,4-trimethyl-	3100	000565-75-3	90
			Pentane, 2,3,4-trimethyl-	64228	000565-75-3	83

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
21	16.24	2.37	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,3-trimethyl-	3088	000560-21-4	83
			Heptane, 3,3,4-trimethyl-	8083	020278-87-9	59
			Decane, 3,3,4-trimethyl-	19045	049622-18-6	59
22	16.55	0.40	C:\DATABASE\NBS75K.L			
			Hexane, 2,3-dimethyl-	3097	000584-94-1	74
			Hexane, 2,3-dimethyl-	64226	000584-94-1	59
			Heptane, 4-methyl-	3096	000589-53-7	46
23	16.87	2.17	C:\DATABASE\NBS75K.L			
			Heptane, 2-methyl-	64219	000592-27-8	91
			Heptane, 2-methyl-	64218	000592-27-8	91
			Heptane, 2-methyl-	3092	000592-27-8	91
24	17.12	0.38	C:\DATABASE\NBS75K.L			
			Aluminum, triethyl-	2984	000097-93-8	16
			3-Hexanone, 4-methyl-	64203	017042-16-9	9
			2(3H)-Furanone, 5-ethyldihydro-	64104	000695-06-7	9
25	17.34	1.63	C:\DATABASE\NBS75K.L			
			Heptane, 3-methyl-	64227	000589-81-1	90
			Heptane, 3,4,5-trimethyl-	8086	020278-89-1	64
			Pyrrolidine, 3-methyl-	637	034375-89-8	50
26	17.98	2.27	C:\DATABASE\NBS75K.L			
			Hexane, 2,2,5-trimethyl-	65129	003522-94-9	83
			Hexane, 2,2,4-trimethyl-	5131	016747-26-5	56
			Hexane, 2,2,5-trimethyl-	5149	003522-94-9	56
27	18.98	0.75	C:\DATABASE\NBS75K.L			
			Heptane, 2,4-dimethyl-	5145	002213-23-2	64
			Heptane, 2,4-dimethyl-	65121	002213-23-2	50
			Pentane, 3-ethyl-3-methyl-	3087	001067-08-9	50
28	20.88	0.26	C:\DATABASE\NBS75K.L			
			Octadecane, 1-chloro-	72489	003386-33-2	59
			Heptane, 2,6-dimethyl-	65137	001072-05-5	50
			3-Ethyl-3-methylheptane	8110	017302-01-1	47
29	21.32	1.03	C:\DATABASE\NBS75K.L			
			4,4-Dimethylcyclooctene	7023	000000-00-0	45
			Octane, 3-methyl-	65130	002216-33-3	40
			Tetracontane, 3,5,24-trimethyl-	60914	055162-61-3	33
30	23.19	0.66	C:\DATABASE\NBS75K.L			
			Benzene, 1,3-dimethyl-	63696	000108-38-3	95
			p-Xylene	63702	000106-42-3	94
			p-Xylene	63700	000106-42-3	94
31	23.65	1.59	C:\DATABASE\NBS75K.L			
			Octane, 3-methyl-	65130	002216-33-3	91
			Heptane, 2,5-dimethyl-	5143	002216-30-0	74
			Heptane, 2,5-dimethyl-	65118	002216-30-0	64

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
32	24.12	0.89	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	59
			Octane, 2,4,6-trimethyl-	11606	062016-37-9	43
			Hexane, 2,2,5-trimethyl-	65126	003522-94-9	42
33	24.56	1.60	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,3,4,6,6-hexamethyl-	19044	062108-32-1	53
			Tridecane, 6-methyl-	22532	013287-21-3	45
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	43
34	25.42	1.20	C:\DATABASE\NBS75K.L			
			Dodecane, 2,7,10-trimethyl-	26005	074645-98-0	53
			Octane, 3-ethyl-2,7-dimethyl-	15359	062183-55-5	53
			Heptadecane, 2,6-dimethyl-	37466	054105-67-8	50
35	26.53	0.82	C:\DATABASE\NBS75K.L			
			Octane, 2,3-dimethyl-	8085	007146-60-3	53
			Heptane, 2,3,5-trimethyl-	8081	020278-85-7	38
			Octane, 2,3-dimethyl-	66214	007146-60-3	38
36	26.67	0.27	C:\DATABASE\NBS75K.L			
			1,7-Octadiyne	63698	000871-84-1	3
			Propiolonitrile	56	001070-71-9	3
			3,3-Dimethylbutylamine	1655	015673-00-4	1
37	27.65	0.24	C:\DATABASE\NBS75K.L			
			Octane, 1,1'-oxybis-	71251	000629-82-3	59
			Octane, 1,1'-oxybis-	32426	000629-82-3	53
			Undecane, 3,6-dimethyl-	19000	017301-28-9	50
38	29.13	0.07	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-3-methyl-	3769	000620-14-4	72
			Benzene, 1-ethyl-2-methyl-	3765	000611-14-3	72
			Benzene, 1-ethyl-3-methyl-	64562	000620-14-4	72
39	29.36	0.22	C:\DATABASE\NBS75K.L			
			Nonane, 4-methyl-	8099	017301-94-9	78
			Pentane, 2,2,3,3-tetramethyl-	5140	007154-79-2	45
			Heptane, 3,5-dimethyl-	65119	000926-82-9	12
40	29.45	3.15	C:\DATABASE\NBS75K.L			
			Octane, 2,2,6-trimethyl-	11599	062016-28-8	64
			2,2,7,7-Tetramethyloctane	15365	001071-31-4	59
			Hexane, 2,2,5,5-tetramethyl-	66226	001071-81-4	50
41	29.96	0.50	C:\DATABASE\NBS75K.L			
			Nonane, 3-methyl-	8075	005911-04-6	72
			Octane, 2,3,7-trimethyl-	11603	062016-34-6	56
			Nonane, 3-methyl-	66202	005911-04-6	56
42	30.17	0.32	C:\DATABASE\NBS75K.L			
			Octane, 2,5,6-trimethyl-	11607	062016-14-2	33
			2-Hexene, 5-methyl-, (E)-	63265	007385-82-2	9
			2,5-Dimethyl-5-hexen-3-ol	5030	067760-91-2	9

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
43	30.29	0.74	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	95
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	94
			Benzene, 1-ethyl-3-methyl-	64562	000620-14-4	94
44	30.65	0.36	C:\DATABASE\NBS75K.L			
			Pentane, 2,2,3,4-tetramethyl-	65146	001186-53-4	64
			2,2,6,6-Tetramethylheptane	11610	040117-45-1	9
			Cyanic acid, ethyl ester	237	000627-48-5	5
45	31.17	0.21	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3-trimethyl-	64573	000526-73-8	93
			Benzene, 1,2,4-trimethyl-	64577	000095-63-6	93
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	93
46	31.20	0.09	C:\DATABASE\NBS75K.L			
			2-Propanamine, N-methyl-	300	004747-21-1	4
			1,2-Ethanediamine, N,N-dimethyl-	843	000108-00-9	4
			Propanal	62330	000123-38-6	3
47	31.40	0.34	C:\DATABASE\NBS75K.L			
			Ethanol, 2-(octyloxy)-	16262	010020-43-6	40
			Nonane, 3-methyl-	66203	005911-04-6	9
			S-Methyl 3-methylbutanethioate	5764	023747-45-7	9
48	31.69	0.43	C:\DATABASE\NBS75K.L			
			Decane	8077	000124-18-5	74
			Decane	66208	000124-18-5	64
			Decane	66207	000124-18-5	64
49	33.30	0.43	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,4,6,6-pentamethyl-	68259	013475-82-6	64
			Hexane, 2,2,3-trimethyl-	5165	016747-25-4	64
			Pentane, 3-ethyl-2,2-dimethyl-	65110	016747-32-3	42
50	33.77	0.34	C:\DATABASE\NBS75K.L			
			Indane	64484	000496-11-7	93
			Indane	3602	000496-11-7	59
			Benzene, 2-propenyl-	64473	000300-57-2	53
51	34.11	0.48	C:\DATABASE\NBS75K.L			
			Nonadecane	37469	000629-92-5	42
			Tetradecane	69661	000629-59-4	40
			Pentadecane	70278	000629-62-9	40
52	35.16	0.24	C:\DATABASE\NBS75K.L			
			Azetidine, 1-methyl-	246	004923-79-9	5
			Cyclobutanone, oxime	622	002972-05-6	4
			1H-Tetrazol-5-amine	612	004418-61-5	4
53	35.27	0.61	C:\DATABASE\NBS75K.L			
			Octyl thioglycolate	23726	007664-80-4	23
			Undecane, 2,6-dimethyl-	19058	017301-23-4	23
			Ethane, isocyanato-	238	000109-90-0	9

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
54	35.53	0.22	C:\DATABASE\NBS75K.L			
			Nonane, 2,3-dimethyl-	11613	002884-06-2	50
			Undecane, 4,6-dimethyl-	19008	017312-82-2	50
			Octane, 1,1'-oxybis-	32426	000629-82-3	45
55	35.69	0.37	C:\DATABASE\NBS75K.L			
			Azetidine, 1-methyl-	246	004923-79-9	9
			Hexane, 1-(hexyloxy)-5-methyl-	23021	074421-19-5	9
			Eicosane	72323	000112-95-8	9
56	35.94	0.29	C:\DATABASE\NBS75K.L			
			Hexacosane	73942	000630-01-3	59
			Nonadecane	37469	000629-92-5	45
			1-Heptadecanamine	34975	004200-95-7	42
57	37.52	0.31	C:\DATABASE\NBS75K.L			
			Hydroxylamine, O-decyl-	15973	029812-79-1	59
			1-Iodo-2-methylundecane	41997	073105-67-6	53
			1-Octanol, 2-butyl-	69110	003913-02-8	50
58	38.93	0.43	C:\DATABASE\NBS75K.L			
			2,2,7,7-Tetramethyloctane	15365	001071-31-4	38
			Heptane, 2,2,3,4,6,6-hexamethyl-	19044	062108-32-1	28
			Hexane, 2,2,5-trimethyl-	65126	003522-94-9	25
59	41.02	0.53	C:\DATABASE\NBS75K.L			
			Dodecane, 2,6,10-trimethyl-	70270	003891-98-3	90
			Dodecane, 2,6,10-trimethyl-	25995	003891-98-3	78
			Dodecane, 2,7,10-trimethyl-	26005	074645-98-0	74
60	41.11	0.31	C:\DATABASE\NBS75K.L			
			Ether, heptyl hexyl	23013	007289-40-9	28
			Azocine, octahydro-	2801	001121-92-2	9
			2H-Pyran, 2-(1,1-dimethylethoxy)te	11931	001927-69-1	9
61	42.30	0.32	C:\DATABASE\NBS75K.L			
			Benzene, 1,3-dimethyl-5-(1-methyle	9379	004706-90-5	38
			Benzene, 2,4-dimethyl-1-(1-methyle	9376	004706-89-2	28
			Ethanone, 1-(3,4-dimethylphenyl)-	66583	003637-01-2	28

Gas2\0809009 126
TIC

Information from Data File:
File : C:\HPCHEM\1\DATA\RUNGAS2\0801009.D
Operator : dls
Acquired : 21 Jun 97 12:17 am using AcqMethod SCAN
Sample Name: GAS2-7, DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8

Search Libraries: C:\DATABASE\NBS75K.L Minimum Quality: 0

Unknown Spectrum: Apex minus start of peak
Integration Params: events.e

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
1	5.21	1.00	C:\DATABASE\NBS75K.L			
			2-Oxo-1-methyl-4,6-diphenyl-1,2-di	36295	021418-80-4	4
			Hydrogen sulfide	19	007783-06-4	3
			Phosphine	20	007803-51-2	3
2	5.30	0.45	C:\DATABASE\NBS75K.L			
			2-Propenoyl chloride	893	000814-68-6	17
			2,4,6,8-Tetrathiatricyclo[3.3.1.13	39669	057274-35-8	12
			2-Oxo-1-methyl-4,6-diphenyl-1,2-di	36295	021418-80-4	12
3	5.76	0.10	C:\DATABASE\NBS75K.L			
			Ethanol	62277	000064-17-5	64
			Ethanol	62276	000064-17-5	9
			Ethanol	62278	000064-17-5	9
4	5.97	0.78	C:\DATABASE\NBS75K.L			
			Butane, 2-methyl-	62518	000078-78-4	91
			Butane, 2-methyl-	62517	000078-78-4	86
			Butane, 2-methyl-	281	000078-78-4	86
5	6.11	0.25	C:\DATABASE\NBS75K.L			
			Acetone	62323	000067-64-1	78
			Acetone	62326	000067-64-1	78
			Acetone	62325	000067-64-1	78
6	6.19	0.08	C:\DATABASE\NBS75K.L			
			2-Butene, 2-methyl-	62462	000513-35-9	64
			1-Butene, 2-methyl-	62458	000563-46-2	50
			2-Pentene, (Z)-	62456	000627-20-3	45
7	6.35	0.86	C:\DATABASE\NBS75K.L			
			Pentane	62515	000109-66-0	90
			Pentane	280	000109-66-0	86
			Pentane	62516	000109-66-0	86
8	6.49	0.22	C:\DATABASE\NBS75K.L			
			2-Pentene	231	000109-68-2	91
			Cyclopropane, 1,2-dimethyl-, cis-	62467	000930-18-7	87
			2-Pentene, (Z)-	62456	000627-20-3	86
9	6.65	0.12	C:\DATABASE\NBS75K.L			
			2-Butene, 2-methyl-	62462	000513-35-9	91
			Cyclopropane, 1,2-dimethyl-, cis-	62467	000930-18-7	90
			2-Butene, 2-methyl-	62461	000513-35-9	90

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
10	6.75	0.34	C:\DATABASE\NBS75K.L			
			Cyclopropane, 1,2-dimethyl-, trans	62459	002402-06-4	91
			Cyclopropane, 1,1-dimethyl-	235	001630-94-0	86
			2-Pentene	231	000109-68-2	78
11	7.05	0.12	C:\DATABASE\NBS75K.L			
			Butane, 2,2-dimethyl-	732	000075-83-2	50
			3-Buten-2-ol	62480	000598-32-3	27
			Azetidine, 2-methyl-	245	019812-49-8	9
12	7.55	0.13	C:\DATABASE\NBS75K.L			
			Cyclopentene	185	000142-29-0	64
			Cyclopentene	62411	000142-29-0	56
			1,3-Pentadiene	178	000504-60-9	49
13	7.80	0.66	C:\DATABASE\NBS75K.L			
			Butane, 2,3-dimethyl-	62870	000079-29-8	86
			Butane, 2,3-dimethyl-	62869	000079-29-8	72
			Butane, 2,3-dimethyl-	735	000079-29-8	64
14	7.89	1.60	C:\DATABASE\NBS75K.L			
			Pentane, 2-methyl-	62864	000107-83-5	72
			Pentane, 2-methyl-	62865	000107-83-5	72
			Pentane, 2-methyl-	62863	000107-83-5	72
15	8.32	1.13	C:\DATABASE\NBS75K.L			
			Pentane, 3-methyl-	62868	000096-14-0	91
			Pentane, 3-methyl-	734	000096-14-0	56
			Pentane, 3-methyl-	62867	000096-14-0	52
16	8.50	0.21	C:\DATABASE\NBS75K.L			
			1-Pentene, 2-methyl-	598	000763-29-1	78
			Cyclopentane, methyl-	62763	000096-37-7	78
			1-Pentene, 2-methyl-	62768	000763-29-1	78
17	8.86	1.62	C:\DATABASE\NBS75K.L			
			Hexane	62874	000110-54-3	90
			Hexane	62873	000110-54-3	78
			Hexane	62872	000110-54-3	78
18	8.95	0.10	C:\DATABASE\NBS75K.L			
			3-Hexene, (Z)-	62780	007642-09-3	90
			2-Hexene	62759	000592-43-8	58
			3-Hexene, (Z)-	607	007642-09-3	58
19	9.05	0.21	C:\DATABASE\NBS75K.L			
			2-Hexene, (E)-	62751	004050-45-7	83
			2-Hexene	62759	000592-43-8	80
			2-Hexene, (Z)-	583	007688-21-3	72
20	9.13	0.24	C:\DATABASE\NBS75K.L			
			Cyclopropane, 1,1,2-trimethyl-	605	004127-45-1	90
			2-Pentene, 4-methyl-, (Z)-	601	000691-38-3	90
			Pentane, 3-methylene-	62767	000760-21-4	86

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
21	9.27	0.22	C:\DATABASE\NBS75K.L			
			2-Pentene, 3-methyl-, (E)-	62773	000616-12-6	47
			2-Pentene, 3-methyl-, (Z)-	608	000922-62-3	46
			2-Pentene, 3-methyl-, (E)-	602	000616-12-6	46
22	9.40	0.15	C:\DATABASE\NBS75K.L			
			3-Hexene, (Z)-	607	007642-09-3	50
			2-Hexene, (E)-	62751	004050-45-7	50
			3-Hexene, (E)-	62750	013269-52-8	50
23	9.63	0.23	C:\DATABASE\NBS75K.L			
			2-Pentene, 3-methyl-, (Z)-	62781	000922-62-3	90
			2-Pentene, 3-methyl-, (Z)-	608	000922-62-3	87
			2-Butene, 2,3-dimethyl-	591	000563-79-1	86
24	9.74	0.11	C:\DATABASE\NBS75K.L			
			Hexane, 2,4-dimethyl-	3089	000589-43-5	64
			Pentane, 2,4-dimethyl-	63425	000108-08-7	47
			1H-Tetrazol-5-amine	612	004418-61-5	43
25	9.96	2.15	C:\DATABASE\NBS75K.L			
			1H-Tetrazole, 5-methyl-	529	004076-36-2	64
			Oxirane, (1-methylbutyl)-	64157	053229-39-3	64
			Cyclohexane	62777	000110-82-7	56
26	10.92	0.33	C:\DATABASE\NBS75K.L			
			Cyclopentene, 3-methyl-	62678	001120-62-3	87
			Cyclopentene, 1-methyl-	62683	000693-89-0	81
			Cyclopentene, 1-methyl-	484	000693-89-0	81
27	11.18	2.84	C:\DATABASE\NBS75K.L			
			Benzene	62628	000071-43-2	91
			Benzene	62627	000071-43-2	91
			Benzene	62626	000071-43-2	91
28	11.42	0.87	C:\DATABASE\NBS75K.L			
			Cyclohexane	62777	000110-82-7	91
			Cyclohexane	62776	000110-82-7	91
			Cyclohexane	606	000110-82-7	91
29	11.64	1.33	C:\DATABASE\NBS75K.L			
			Hexane, 2-methyl-	1598	000591-76-4	91
			Hexane, 2-methyl-	63435	000591-76-4	91
			Hexane, 2-methyl-	63434	000591-76-4	86
30	11.76	1.98	C:\DATABASE\NBS75K.L			
			Pentane, 2,3-dimethyl-	63432	000565-59-3	87
			Pentane, 2,3-dimethyl-	63430	000565-59-3	83
			Pentane, 2,3-dimethyl-	1597	000565-59-3	58
31	12.06	1.60	C:\DATABASE\NBS75K.L			
			Hexane, 3-methyl-	1593	000589-34-4	91
			Hexane, 3-methyl-	63421	000589-34-4	83
			Hexane, 3-methyl-	63423	000589-34-4	72

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
32	12.49	0.43	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-, trans	1329	001759-58-6	91
			Cyclopentane, 1,3-dimethyl-	1316	002453-00-1	72
			2H-Pyran-2,6(3H)-dione, dihydro-4,	7843	004160-82-1	72
33	12.63	0.57	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-, cis-	63267	002532-58-3	94
			Cyclopentane, 1,3-dimethyl-, trans	1329	001759-58-6	91
			Cyclopentane, 1,2-dimethyl-, cis-	63274	001192-18-3	91
34	12.74	2.88	C:\DATABASE\NBS75K.L			
			Butane, 2,2,3,3-tetramethyl-	64214	000594-82-1	78
			Butane, 2,2,3,3-tetramethyl-	64215	000594-82-1	72
			Pentane, 2,2,4-trimethyl-	64220	000540-84-1	72
35	13.30	1.36	C:\DATABASE\NBS75K.L			
			Heptane	63438	000142-82-5	91
			Heptane	63439	000142-82-5	91
			Heptane	63440	000142-82-5	78
36	13.46	0.44	C:\DATABASE\NBS75K.L			
			2-Pentene, 3-ethyl-	1342	000816-79-5	81
			3-Hexene, 3-methyl-, (Z)-	1355	004914-89-0	74
			2-Hexene, 3-methyl-, (Z)-	1322	010574-36-4	72
37	13.62	0.11	C:\DATABASE\NBS75K.L			
			2-Heptene, (E)-	1347	014686-13-6	90
			2-Heptene, (E)-	63254	014686-13-6	86
			Cycloheptane	1324	000291-64-5	38
38	13.88	0.12	C:\DATABASE\NBS75K.L			
			2-Hexene, 3-methyl-, (Z)-	1322	010574-36-4	90
			3-Hexene, 3-methyl-, (Z)-	63262	004914-89-0	64
			1-Pentene, 3-ethyl-	1343	004038-04-4	50
39	14.03	0.03	C:\DATABASE\NBS75K.L			
			Cyclopentene, 1,5-dimethyl-	1136	016491-15-9	72
			Cyclopentene, 4,4-dimethyl-	1107	019037-72-0	72
			Furan, 2-ethyl-	1094	003208-16-0	64
40	14.61	1.04	C:\DATABASE\NBS75K.L			
			Cyclohexane, methyl-	63236	000108-87-2	97
			Cyclohexane, methyl-	63235	000108-87-2	95
			Cyclohexane, methyl-	1326	000108-87-2	94
41	15.08	0.40	C:\DATABASE\NBS75K.L			
			Hexane, 2,5-dimethyl-	64204	000592-13-2	91
			Hexane, 2,5-dimethyl-	64206	000592-13-2	83
			Heptane, 2-methyl-	64219	000592-27-8	64
42	15.22	0.77	C:\DATABASE\NBS75K.L			
			Hexane, 2,4-dimethyl-	64212	000589-43-5	64
			Hexane, 2,4-dimethyl-	3089	000589-43-5	58
			Hexane, 2,4-dimethyl-	64213	000589-43-5	58

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
43	15.65	0.19	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,2,4-trimethyl-	2680	002815-58-9	91
			Cyclopentane, 1,2,4-trimethyl-, (1	2684	004850-28-6	72
			Cyclopentane, 1,2,4-trimethyl-, (1	2652	016883-48-0	72
44	16.10	0.12	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,2,3-trimethyl-, (1	2718	015890-40-1	64
			cis-1-Butyl-2-methylcyclopropane	2683	038851-69-3	59
			1-Octene, 3,7-dimethyl-	66071	004984-01-4	59
45	16.22	1.30	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	91
			Pentane, 2,3,4-trimethyl-	64228	000565-75-3	86
			Heptane, 3,3,4-trimethyl-	8083	020278-87-9	78
46	16.39	0.19	C:\DATABASE\NBS75K.L			
			Cyclopentene, 4,4-dimethyl-	1107	019037-72-0	80
			3,5-Dimethylcyclopentene	1128	007459-71-4	72
			1,4-Pentadiene, 3,3-dimethyl-	1110	001112-35-2	72
47	16.52	1.53	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,3-trimethyl-	3088	000560-21-4	90
			Heptane, 4-methyl-	3096	000589-53-7	59
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	53
48	16.92	11.92	C:\DATABASE\NBS75K.L			
			Toluene	63030	000108-88-3	94
			1,3,5-Cycloheptatriene	63035	000544-25-2	91
			Toluene	965	000108-88-3	91
49	17.14	0.56	C:\DATABASE\NBS75K.L			
			Heptane, 2-methyl-	64219	000592-27-8	90
			Heptane, 2-methyl-	3092	000592-27-8	53
			Heptane, 2-methyl-	64218	000592-27-8	49
50	17.25	0.27	C:\DATABASE\NBS75K.L			
			Decane, 3,3,4-trimethyl-	19045	049622-18-6	78
			Pentane, 3-ethyl-	1595	000617-78-7	72
			Heptane, 4-methyl-	64225	000589-53-7	72
51	17.38	0.28	C:\DATABASE\NBS75K.L			
			Hexane, 3,4-dimethyl-	64211	000583-48-2	64
			Heptane, 2,2,3,4,6,6-hexamethyl-	19044	062108-32-1	36
			2H-Pyran-2-one, tetrahydro-5,6-dim	4947	024405-16-1	23
52	17.62	0.65	C:\DATABASE\NBS75K.L			
			Heptane, 3-methyl-	64227	000589-81-1	80
			Heptane, 3,4,5-trimethyl-	8086	020278-89-1	72
			Hexane, 2,4-dimethyl-	3089	000589-43-5	58
53	17.71	0.23	C:\DATABASE\NBS75K.L			
			1-Heptene, 5-methyl-	2667	013151-04-7	25
			Undecane, 3-methylene-	14736	071138-64-2	23
			1-Octene, 3-ethyl-	7585	074630-08-3	12

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
54	17.97	0.20	C:\DATABASE\NBS75K.L			
			Cyclohexane, 1,2-dimethyl-, cis-	63988	002207-01-4	52
			Cyclohexane, 1,2-dimethyl-, cis-	2653	002207-01-4	52
			Cyclopentane, 1,2,3-trimethyl-, (1	2718	015890-40-1	50
55	18.26	0.43	C:\DATABASE\NBS75K.L			
			Hexane, 2,2,5-trimethyl-	65129	003522-94-9	83
			Hexane, 2,2,4-trimethyl-	5131	016747-26-5	83
			Heptane, 4-ethyl-2,2,6,6-tetrameth	19042	062108-31-0	78
56	18.59	0.15	C:\DATABASE\NBS75K.L			
			2H-Pyran, 3,4-dihydro-	62716	000110-87-2	14
			1,3-Cyclopentanediol, cis-	1701	016326-97-9	10
			2-Pentenal, (E)-	567	001576-87-0	9
57	18.73	0.13	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1-ethyl-3-methyl-, c	2702	002613-66-3	59
			Cyclopentane, 1-ethyl-3-methyl-, t	2698	002613-65-2	59
			Cyclopentane, 1-ethyl-3-methyl-	2696	003726-47-4	59
58	19.03	0.15	C:\DATABASE\NBS75K.L			
			2,4-Hexadiene, 3,4-dimethyl-, (Z,Z	2381	021293-01-6	43
			Cyclopropane, tetramethylmethylene	2375	054376-39-5	43
			5,5-Dimethyl-1,3-hexadiene	2323	001515-79-3	38
59	19.19	0.14	C:\DATABASE\NBS75K.L			
			4-Octene, (E)-	64041	014850-23-8	74
			2-Octene, (E)-	64022	013389-42-9	68
			4-Octene, (E)-	64042	014850-23-8	64
60	19.28	0.63	C:\DATABASE\NBS75K.L			
			Octane	64208	000111-65-9	90
			Octane	3084	000111-65-9	78
			Undecane, 2,4-dimethyl-	69023	017312-80-0	59
61	19.88	0.20	C:\DATABASE\NBS75K.L			
			1,3-Dimethyl-1-cyclohexene	2371	002808-76-6	90
			Cyclopentene, 1,2,3-trimethyl-	2340	000473-91-6	80
			exo-2-Bromonorbornane	68413	002534-77-2	72
62	20.34	0.09	C:\DATABASE\NBS75K.L			
			Heptane, 2,3-dimethyl-	65133	003074-71-3	78
			Hexane, 3-ethyl-	64222	000619-99-8	74
			Heptane, 2,3-dimethyl-	5152	003074-71-3	74
63	20.78	0.13	C:\DATABASE\NBS75K.L			
			Heptane, 2,4-dimethyl-	65121	002213-23-2	38
			Hexane, 3-ethyl-	64222	000619-99-8	37
			2,4,6,8-Tetramethyl-1-undecene	25485	059920-26-2	37
64	21.18	0.13	C:\DATABASE\NBS75K.L			
			Heptane, 2,6-dimethyl-	65137	001072-05-5	59
			Octane, 1,1'-oxybis-	71250	000629-82-3	59
			Undecane	67317	001120-21-4	59

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
65	21.63	0.25	C:\DATABASE\NBS75K.L			
			Heptane, 3,5-dimethyl-	65119	000926-82-9	64
			Heptane, 3,5-dimethyl-	5144	000926-82-9	64
			Heptane, 2,5-dimethyl-	65118	002216-30-0	64
66	22.99	3.77	C:\DATABASE\NBS75K.L			
			Ethylbenzene	63691	000100-41-4	94
			Ethylbenzene	63690	000100-41-4	91
			Ethylbenzene	2026	000100-41-4	91
67	23.52	10.76	C:\DATABASE\NBS75K.L			
			Benzene, 1,3-dimethyl-	63696	000108-38-3	97
			Benzene, 1,3-dimethyl-	63695	000108-38-3	97
			p-Xylene	63702	000106-42-3	95
68	23.95	0.35	C:\DATABASE\NBS75K.L			
			Octane, 3-methyl-	5150	002216-33-3	91
			Octane, 3-methyl-	65130	002216-33-3	72
			Decane, 2,5-dimethyl-	68262	017312-50-4	59
69	24.42	0.19	C:\DATABASE\NBS75K.L			
			Decane, 2,2,7-trimethyl-	19001	062237-99-4	72
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	64
			Decane, 2,2,8-trimethyl-	19012	062238-01-1	56
70	24.88	0.39	C:\DATABASE\NBS75K.L			
			Decane, 2,2,8-trimethyl-	19012	062238-01-1	72
			Heptane, 2,2,3,4,6,6-hexamethyl-	19044	062108-32-1	64
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	59
71	25.06	4.67	C:\DATABASE\NBS75K.L			
			Benzene, 1,2-dimethyl-	63707	000095-47-6	94
			p-Xylene	63699	000106-42-3	93
			p-Xylene	63702	000106-42-3	93
72	25.73	0.47	C:\DATABASE\NBS75K.L			
			Undecane, 4,6-dimethyl-	19008	017312-82-2	83
			Dodecane, 4,6-dimethyl-	22539	061141-72-8	72
			Dodecane, 2,6,11-trimethyl-	25998	031295-56-4	72
73	26.85	0.22	C:\DATABASE\NBS75K.L			
			Nonane, 4-methyl-	66223	017301-94-9	53
			Heptane, 3-ethyl-	65116	015869-80-4	50
			Heptane, 3-ethyl-2-methyl-	66211	014676-29-0	45
74	27.13	0.31	C:\DATABASE\NBS75K.L			
			Benzene, (1-methylethyl)-	64556	000098-82-8	91
			Benzene, 1,2,3-trimethyl-	3773	000526-73-8	91
			Benzene, (1-methylethyl)-	64552	000098-82-8	91
75	27.98	0.09	C:\DATABASE\NBS75K.L			
			Nonane, 3-methyl-	8075	005911-04-6	47
			Octadecane, 2,2,4,15,17,17-hexamet	60724	055470-97-8	47
			1-Pentanol, 4-methyl-2-propyl-	8543	054004-41-0	47

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
76	29.00	1.16	C:\DATABASE\NBS75K.L			
			Benzene, propyl-	64583	000103-65-1	91
			Benzene, propyl-	64582	000103-65-1	91
			Benzene, propyl-	3781	000103-65-1	91
77	29.47	3.44	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-3-methyl-	64563	000620-14-4	95
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	95
			Benzene, 1-ethyl-2-methyl-	3765	000611-14-3	95
78	29.59	1.57	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	94
			Benzene, 1-ethyl-2-methyl-	3765	000611-14-3	94
			Benzene, 1-ethyl-2-methyl-	64558	000611-14-3	94
79	29.79	0.59	C:\DATABASE\NBS75K.L			
			2,2,7,7-Tetramethyloctane	15365	001071-31-4	64
			Hexane, 2,2,5,5-tetramethyl-	66226	001071-81-4	53
			Heptane, 2,2-dimethyl-	65135	001071-26-7	53
80	29.92	1.89	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64570	000108-67-8	97
			Benzene, 1,2,3-trimethyl-	64573	000526-73-8	95
			Benzene, 1,2,4-trimethyl-	64577	000095-63-6	94
81	30.28	0.15	C:\DATABASE\NBS75K.L			
			Nonane, 3-methyl-	66200	005911-04-6	78
			Nonane, 3-methyl-	8075	005911-04-6	78
			Octane, 3,6-dimethyl-	8109	015869-94-0	78
82	30.63	1.42	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-4-methyl-	3770	000622-96-8	94
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	94
			Benzene, 1-ethyl-3-methyl-	3769	000620-14-4	91
83	31.52	5.28	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3-trimethyl-	64576	000526-73-8	95
			Benzene, 1,2,3-trimethyl-	64573	000526-73-8	95
			1,2,4-Trimethylbenzene	3771	000095-36-3	94
84	32.01	0.15	C:\DATABASE\NBS75K.L			
			Decane	66207	000124-18-5	72
			Ether, heptyl hexyl	23013	007289-40-9	64
			Nonane	65143	000111-84-2	64
85	32.62	0.10	C:\DATABASE\NBS75K.L			
			Benzene, (1-methylpropyl)-	65542	000135-98-8	86
			Benzeneacetaldehyde, .alpha.-methy	6164	000093-53-8	78
			Benzene, (1-methylpropyl)-	65544	000135-98-8	72
86	33.31	1.47	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	94
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	93
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	93

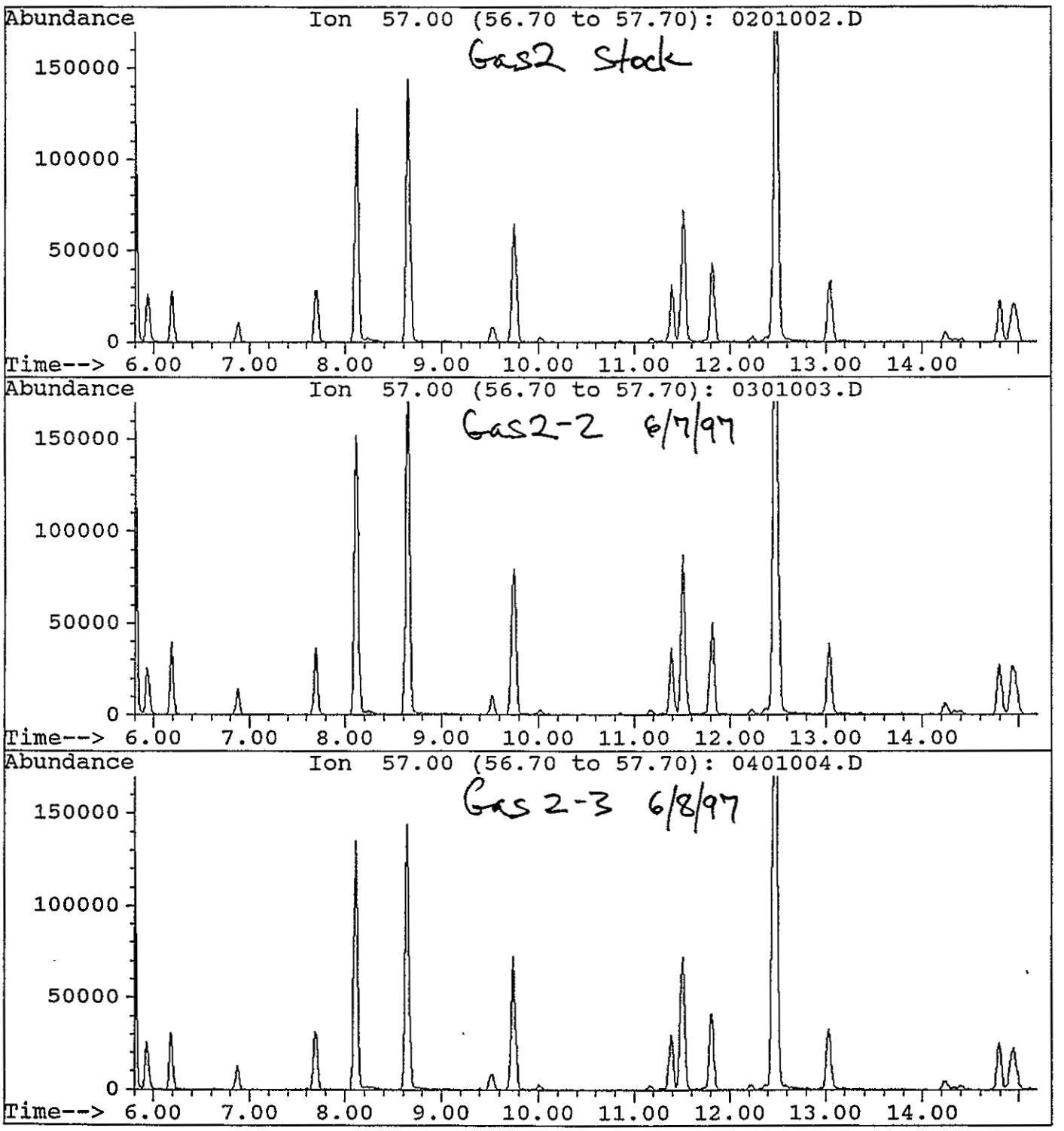
Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
87	33.63	0.10	C:\DATABASE\NBS75K.L			
			Decane, 2,2,7-trimethyl-	19001	062237-99-4	78
			Hexane, 2,2,5-trimethyl-	65126	003522-94-9	59
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	56
88	34.13	0.65	C:\DATABASE\NBS75K.L			
			Benzene, 2-propenyl-	64472	000300-57-2	81
			Indane	64484	000496-11-7	76
			Benzene, cyclopropyl-	64468	000873-49-4	70
89	34.44	0.17	C:\DATABASE\NBS75K.L			
			Undecane, 4,6-dimethyl-	19008	017312-82-2	72
			Tridecane	69020	000629-50-5	64
			Decane, 3-methyl-	67314	013151-34-3	59
90	34.87	0.30	C:\DATABASE\NBS75K.L			
			Benzene, 1,2-diethyl-	65561	000135-01-3	97
			Benzene, 1,2-diethyl-	65562	000135-01-3	94
			Benzene, 1,3-diethyl-	65566	000141-93-5	94
91	35.00	0.79	C:\DATABASE\NBS75K.L			
			Benzene, (1-methylpropyl)-	65544	000135-98-8	90
			Benzene, (1-methylpropyl)-	65543	000135-98-8	90
			Benzene, 1-methyl-2-propyl-	65584	001074-17-5	90
92	35.25	0.54	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-2-propyl-	65584	001074-17-5	83
			Benzene, (1-methylpropyl)-	65542	000135-98-8	83
			Benzene, (1-methylpropyl)-	65543	000135-98-8	83
93	35.38	1.02	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethyl-1,4-dimethyl-	6219	001758-88-9	94
			Benzene, 4-ethyl-1,2-dimethyl-	6218	000934-80-5	91
			Benzene, 2-ethyl-1,3-dimethyl-	6200	002870-04-4	91
94	35.62	0.26	C:\DATABASE\NBS75K.L			
			Undecane, 2,6-dimethyl-	19058	017301-23-4	35
			Octane, 4-ethyl-	8095	015869-86-0	25
			Azetidine, 1-methyl-	246	004923-79-9	25
95	36.00	0.33	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-4-propyl-	6216	001074-55-1	81
			Benzene, 1-methyl-3-propyl-	65527	001074-43-7	81
			Benzene, 1-methyl-3-propyl-	6195	001074-43-7	81
96	36.54	0.49	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-4-(1-methylethyl	65535	000099-87-6	93
			Benzene, 1-ethyl-2,3-dimethyl-	6211	000933-98-2	91
			Benzene, 1-ethyl-3,5-dimethyl-	65554	000934-74-7	91
97	36.66	0.47	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethyl-1,3-dimethyl-	6200	002870-04-4	91
			Benzene, 1,2,4,5-tetramethyl-	65575	000095-93-2	91
			Benzene, 1,2,3,4-tetramethyl-	6202	000488-23-3	91

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
98	37.00	0.84	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-2-(1-methylethyl	6228	000527-84-4	97
			Benzene, 1-methyl-3-(1-methylethyl	6225	000535-77-3	97
			Benzene, 1-methyl-2-(1-methylethyl	65581	000527-84-4	97
99	37.17	0.19	C:\DATABASE\NBS75K.L			
			2,3-Dihydro-1-methylindene	5901	027133-93-3	90
			Benzene, 1-methyl-2-(2-propenyl)-	65419	001587-04-8	83
			Indan, 1-methyl-	65418	000767-58-8	80
100	37.85	0.16	C:\DATABASE\NBS75K.L			
			Undecane	67317	001120-21-4	87
			Eicosane	72324	000112-95-8	83
			Eicosane	72326	000112-95-8	78
101	38.20	0.19	C:\DATABASE\NBS75K.L			
			Benzene, 4-ethyl-1,2-dimethyl-	65569	000934-80-5	94
			Benzene, 1-ethyl-2,3-dimethyl-	65556	000933-98-2	94
			Benzene, 1-ethyl-2,4-dimethyl-	65573	000874-41-9	91
102	38.74	0.56	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3,5-tetramethyl-	6220	000527-53-7	94
			Benzene, 1,2,4,5-tetramethyl-	65574	000095-93-2	94
			Benzene, 1,2,4,5-tetramethyl-	65576	000095-93-2	94
103	38.95	0.75	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3,5-tetramethyl-	6220	000527-53-7	94
			Benzene, 1,2,4,5-tetramethyl-	65576	000095-93-2	94
			Benzene, 1-methyl-3-(1-methylethyl	65579	000535-77-3	94
104	39.71	0.12	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethyl-1,4-dimethyl-	6219	001758-88-9	64
			Benzene, 2-ethyl-1,4-dimethyl-	65570	001758-88-9	64
			Benzene, 1-ethyl-2,3-dimethyl-	65555	000933-98-2	64
105	39.95	0.43	C:\DATABASE\NBS75K.L			
			1H-Indene, 2,3-dihydro-5-methyl-	5885	000874-35-1	81
			1H-Indene, 2,3-dihydro-4-methyl-	5893	000824-22-6	68
			Benzene, (2-methyl-1-propenyl)-	65428	000768-49-0	58
106	40.05	0.09	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-3,5-dimethyl-	65554	000934-74-7	42
			1-Butanamine, N-(2-pyridinylmethyl	12959	007032-24-8	36
			Benzene, 4-ethyl-1,2-dimethyl-	65567	000934-80-5	9
107	40.48	0.57	C:\DATABASE\NBS75K.L			
			Indan, 1-methyl-	5882	000767-58-8	94
			Benzene, (2-methyl-1-propenyl)-	65428	000768-49-0	91
			2,3-Dihydro-1-methylindene	5901	027133-93-3	90
108	40.59	0.28	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethyl-1,4-dimethyl-	65570	001758-88-9	86
			Benzene, 1-ethyl-3,5-dimethyl-	65554	000934-74-7	86
			Benzene, 1-ethyl-2,3-dimethyl-	6211	000933-98-2	86

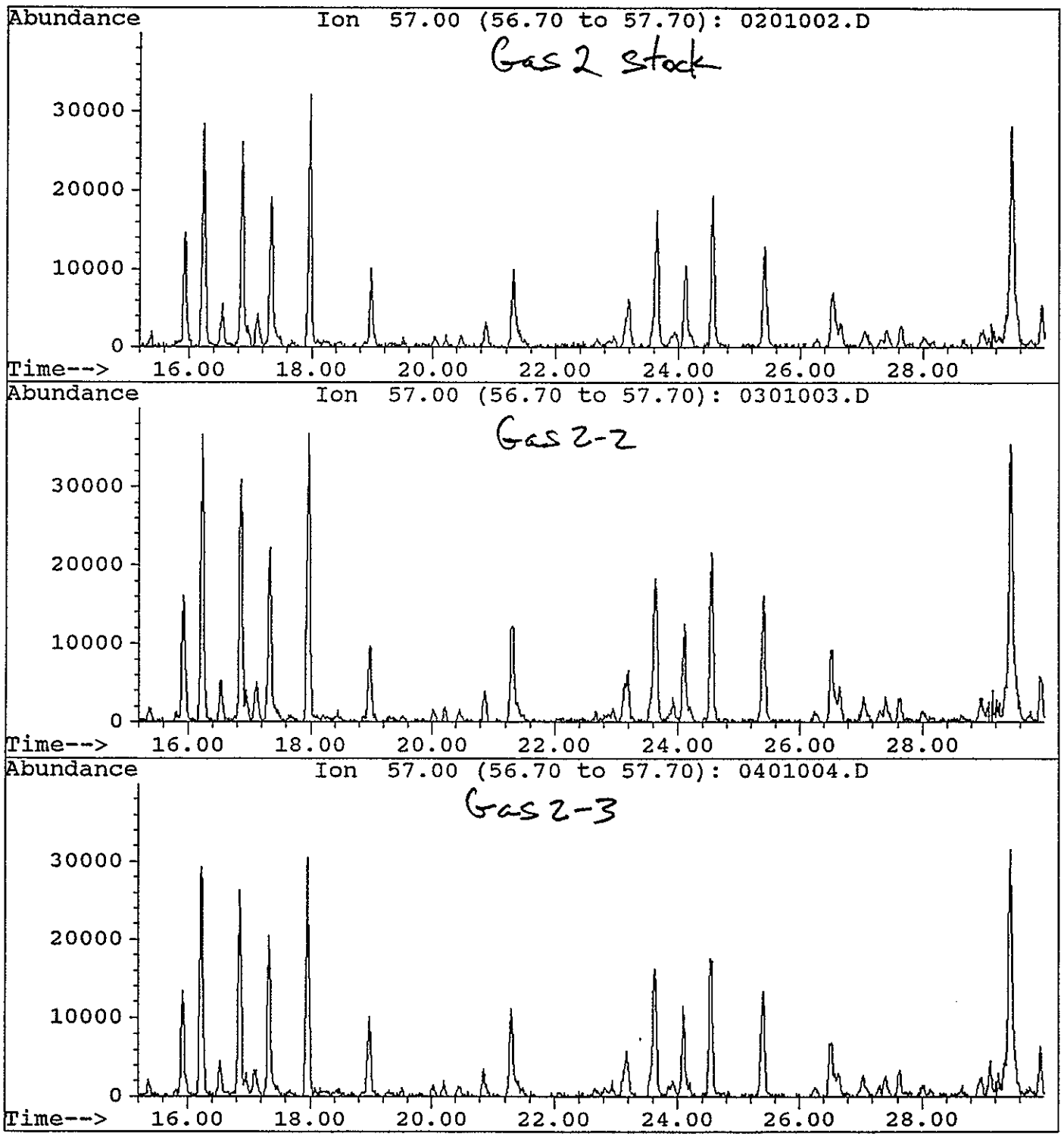
Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
109	41.31	0.18	C:\DATABASE\NBS75K.L			
			Dodecane, 2,6,11-trimethyl-	25998	031295-56-4	78
			Octane, 3,6-dimethyl-	8109	015869-94-0	64
			Dodecane, 2,7,10-trimethyl-	26005	074645-98-0	64
110	41.51	0.13	C:\DATABASE\NBS75K.L			
			Benzene, (1,1-dimethylpropyl)-	66630	002049-95-8	78
			Benzene, 2-ethyl-1,3-dimethyl-	6200	002870-04-4	72
			Benzene, 1-methyl-2-(1-methylethyl	6228	000527-84-4	72
111	42.11	0.88	C:\DATABASE\NBS75K.L			
			Naphthalene	5167	000091-20-3	94
			Naphthalene	65151	000091-20-3	90
			Naphthalene	65149	000091-20-3	90
112	42.57	0.31	C:\DATABASE\NBS75K.L			
			Benzene, 2,4-dimethyl-1-(1-methyle	9376	004706-89-2	60
			Benzene, 1-(1,1-dimethylethyl)-3-m	66632	001075-38-3	49
			Benzene, 1,4-dimethyl-2-(1-methyle	9382	004132-72-3	47
113	42.68	0.20	C:\DATABASE\NBS75K.L			
			Naphthalene, 1,2,3,4-tetrahydro-1-	8942	001559-81-5	55
			Benzene, (1,1-dimethyl-2-propenyl)	8972	018321-36-3	53
			Benzene, (3-methyl-2-butenyl)-	8959	004489-84-3	47
114	44.88	0.08	C:\DATABASE\NBS75K.L			
			1H-Indene, 2,3-dihydro-1,3-dimethy	8968	004175-53-5	72
			1H-Indene, 2,3-dihydro-1,6-dimethy	8967	017059-48-2	64
			1H-Indene, 2,3-dihydro-4,6-dimethy	8950	001685-82-1	38
115	46.70	0.29	C:\DATABASE\NBS75K.L			
			Naphthalene, 1-methyl-	66231	000090-12-0	91
			Naphthalene, 1-methyl-	66233	000090-12-0	91
			Naphthalene, 1-methyl-	66230	000090-12-0	91
116	47.37	0.11	C:\DATABASE\NBS75K.L			
			Naphthalene, 1-methyl-	66233	000090-12-0	90
			Naphthalene, 2-methyl-	66237	000091-57-6	90
			Naphthalene, 1-methyl-	66230	000090-12-0	90

m/e 57
Non-aromatics (alkanes)

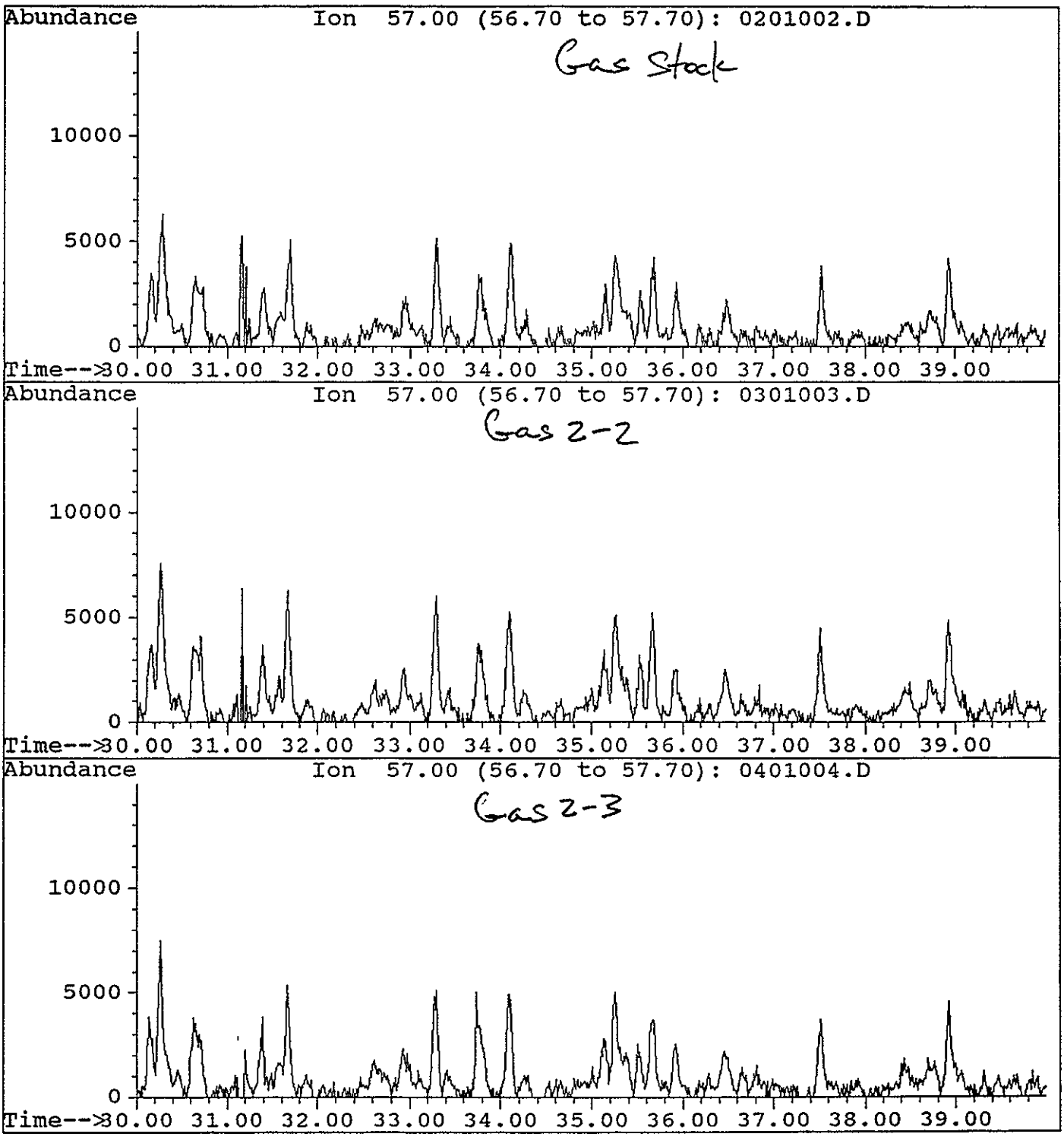
File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4



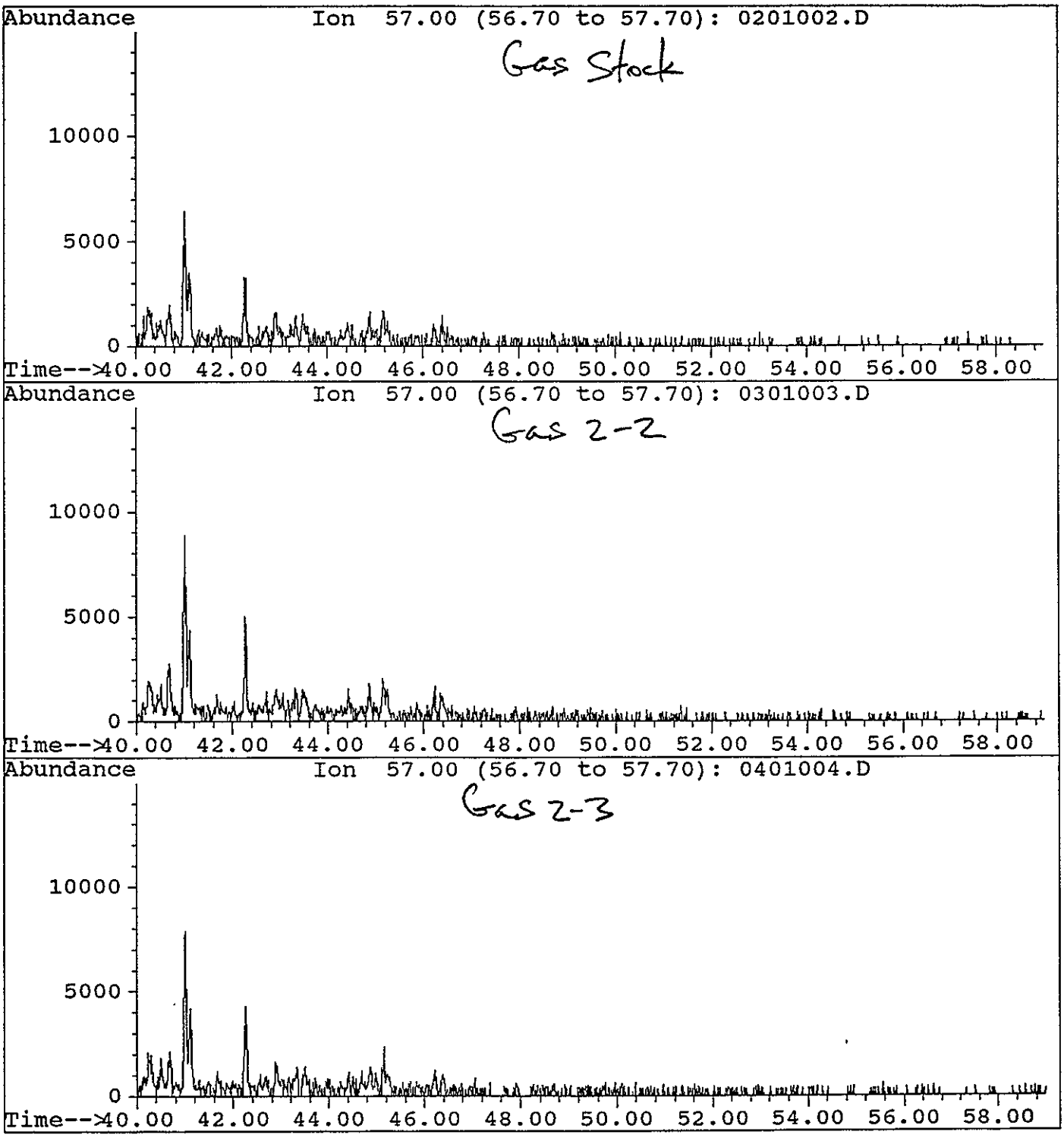
File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4



File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4

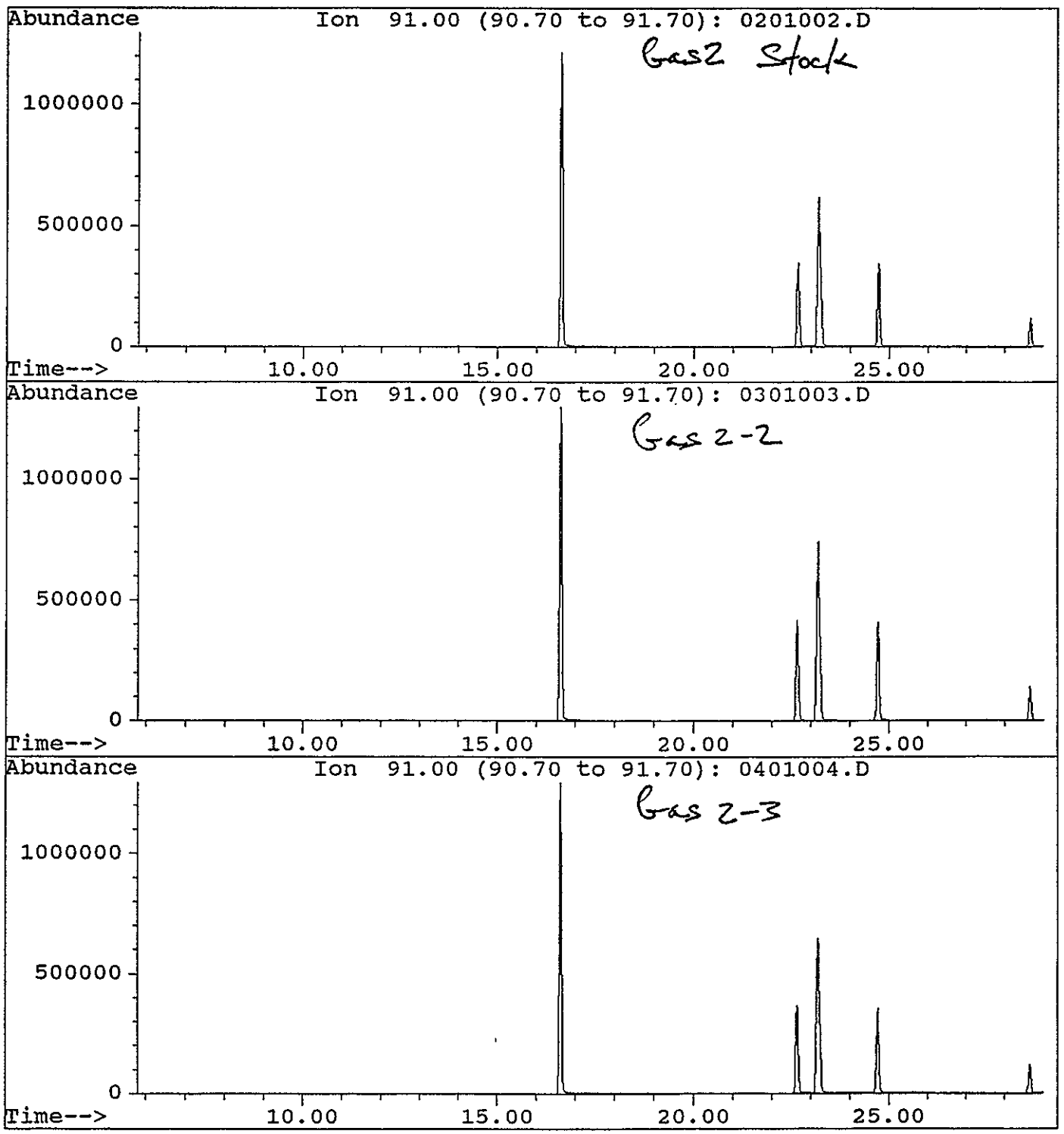


File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4

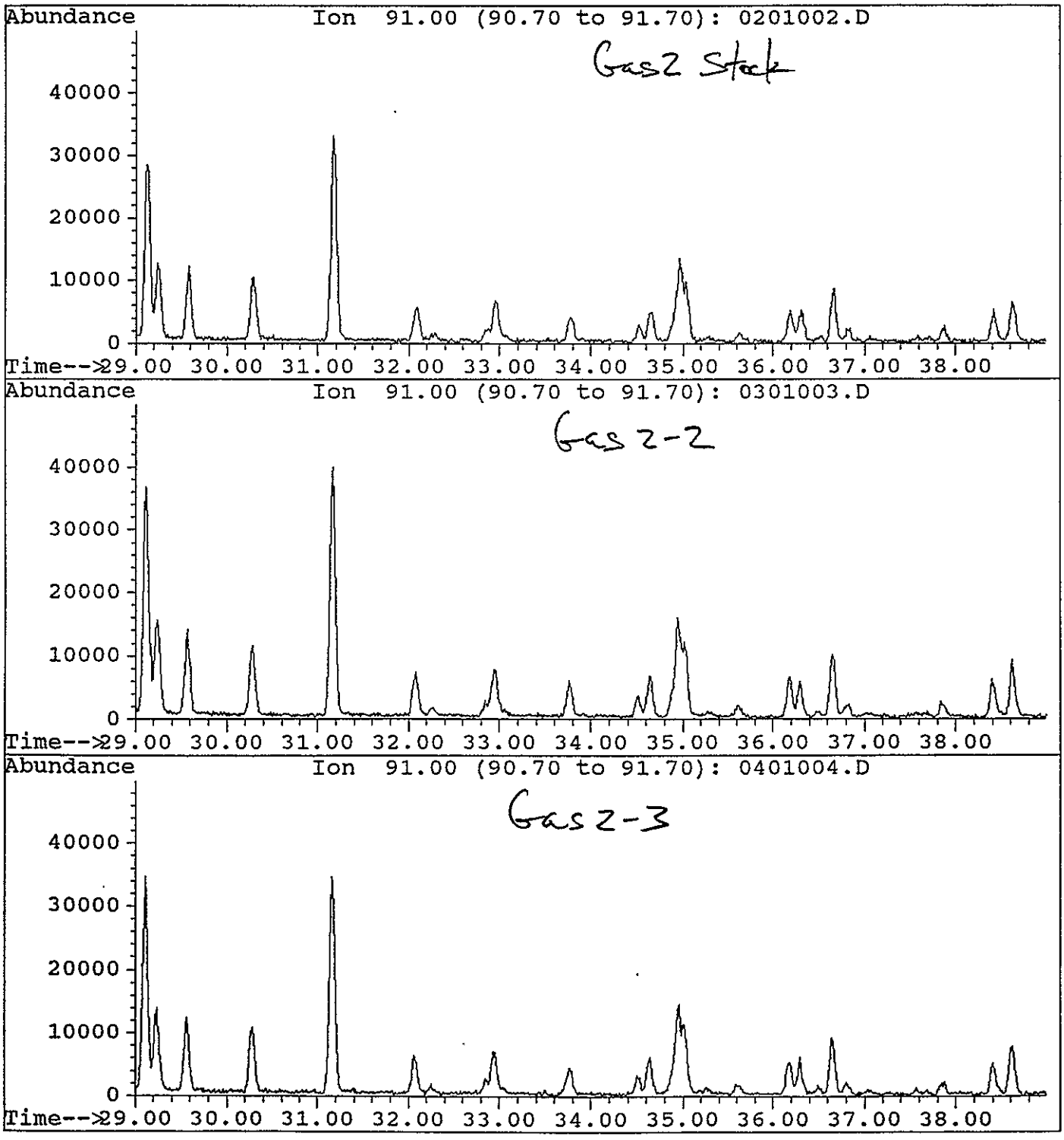


m/e 91
Aromatics

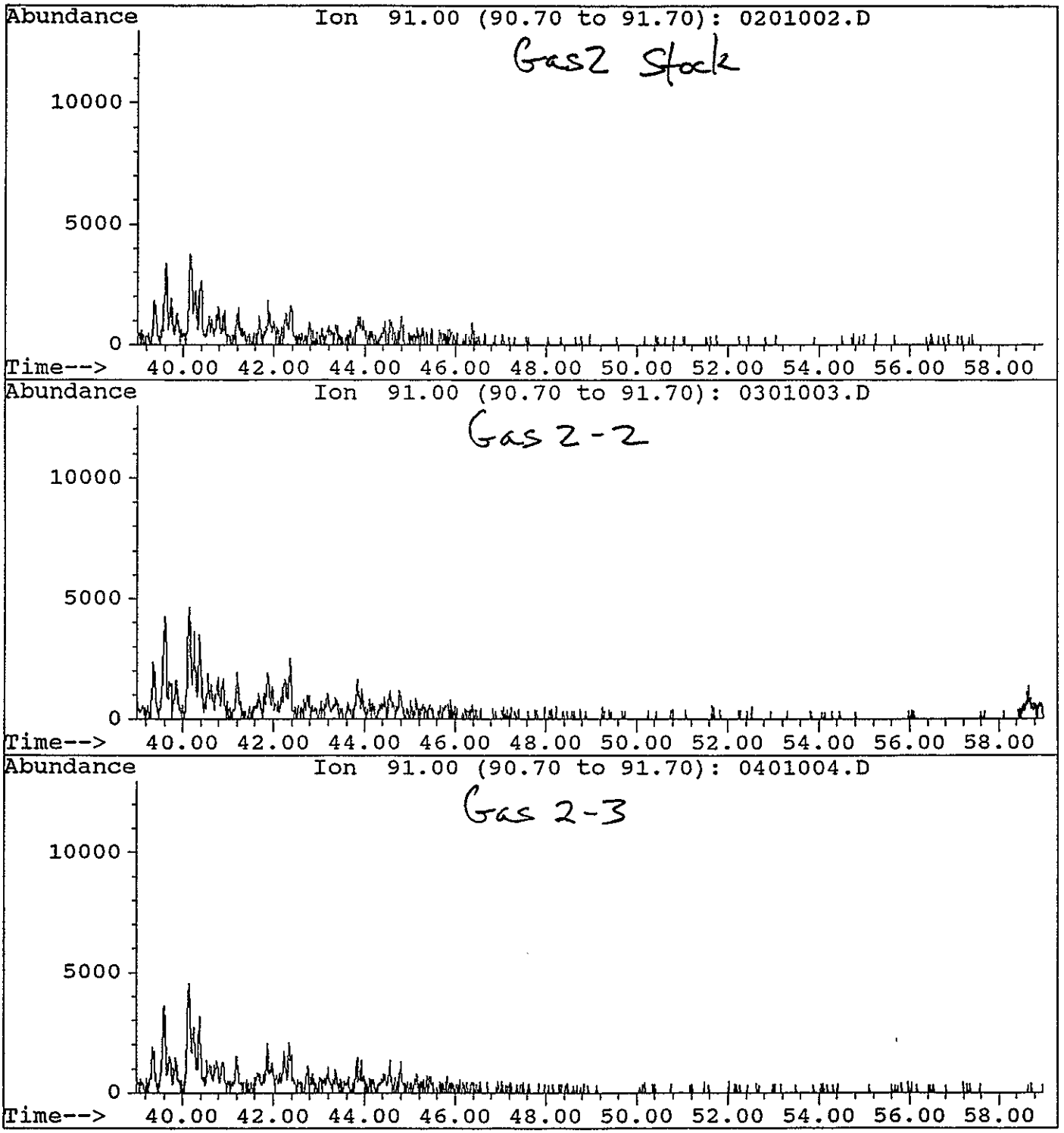
File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4



File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4

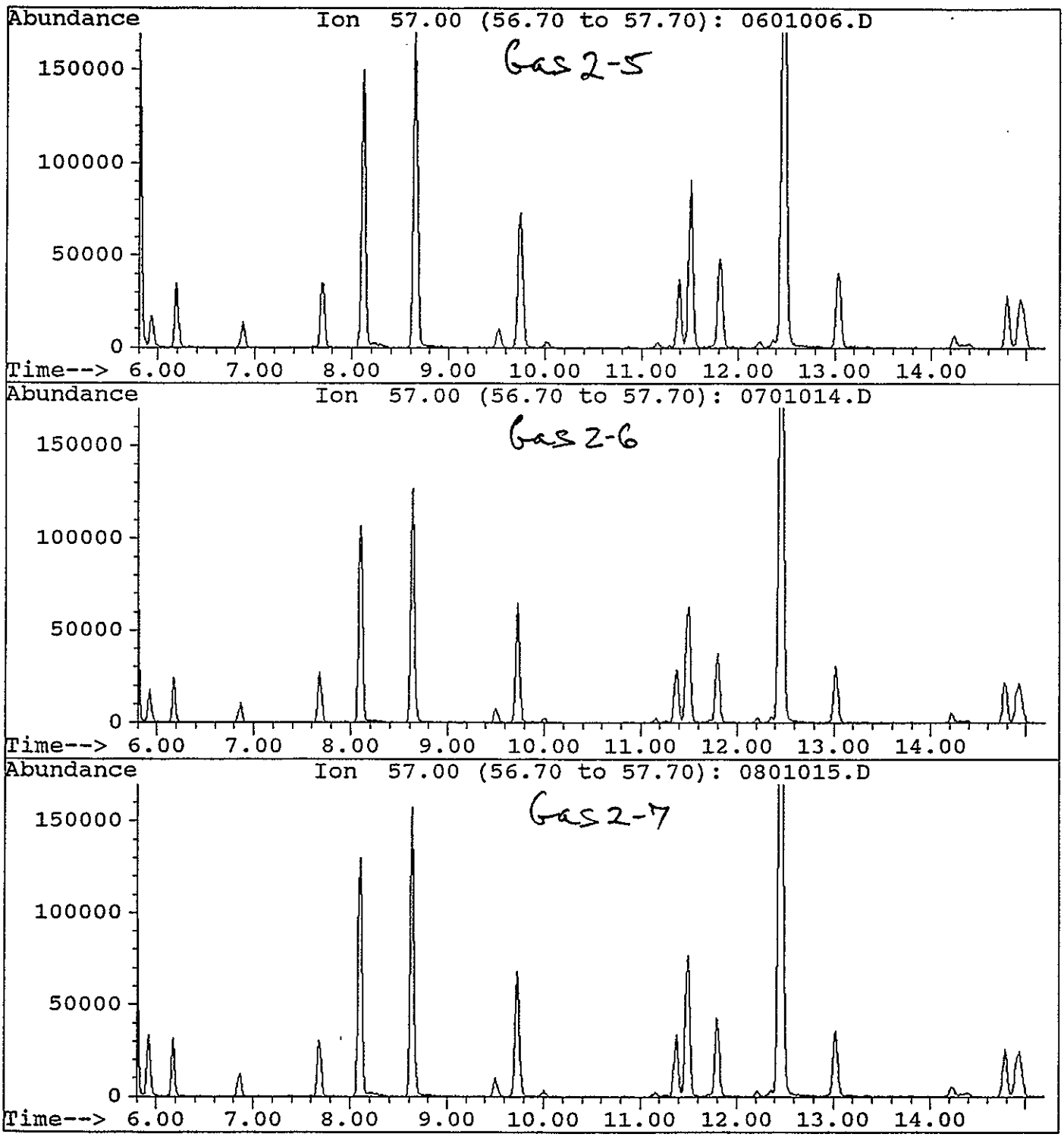


File : C:\HPCHEM\1\DATA\RUNGAS\0401004.D
Operator :
Acquired : 13 Jun 97 7:58 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-3, 6/8/97 DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 4

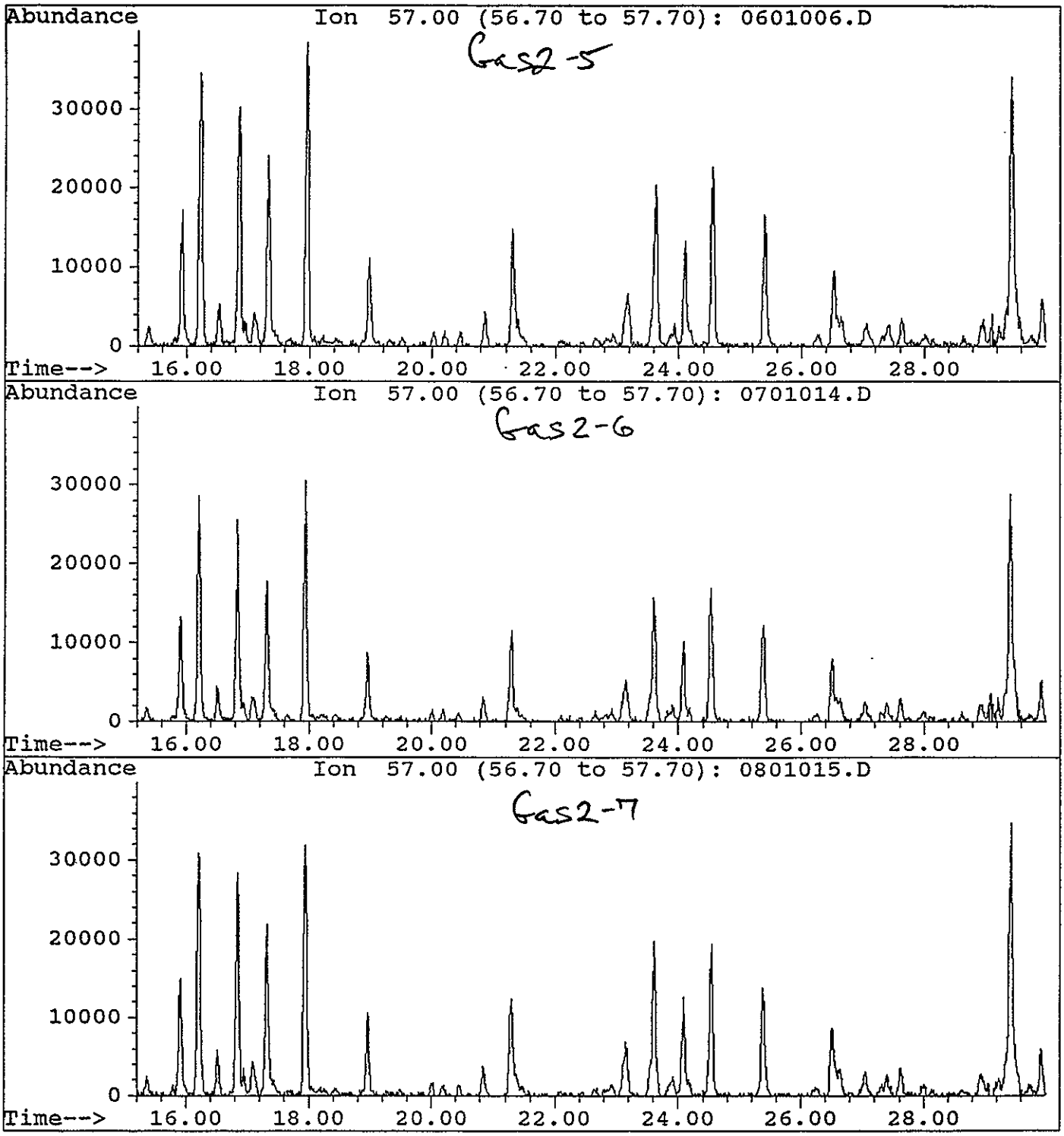


m/e 57
Alkanes

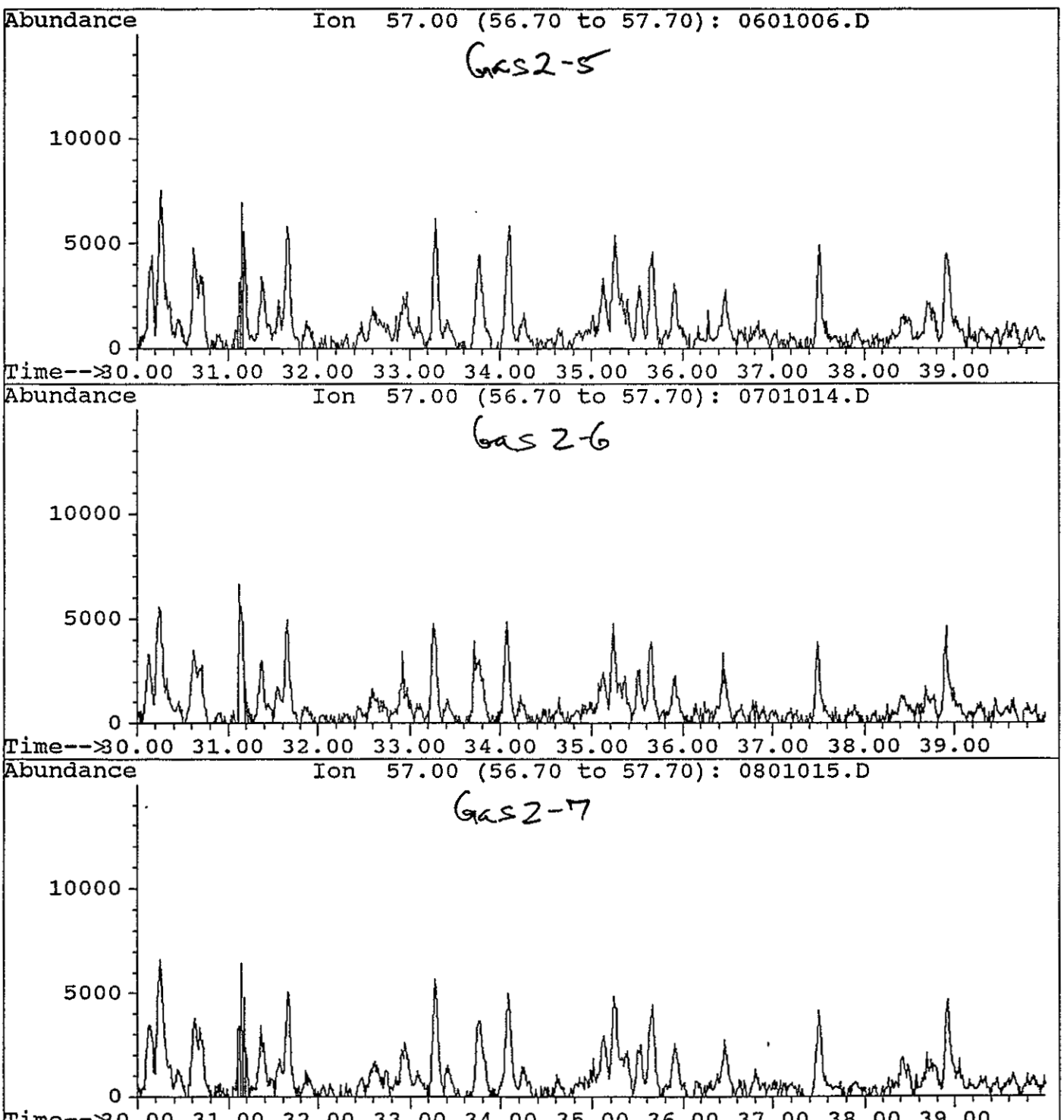
File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8



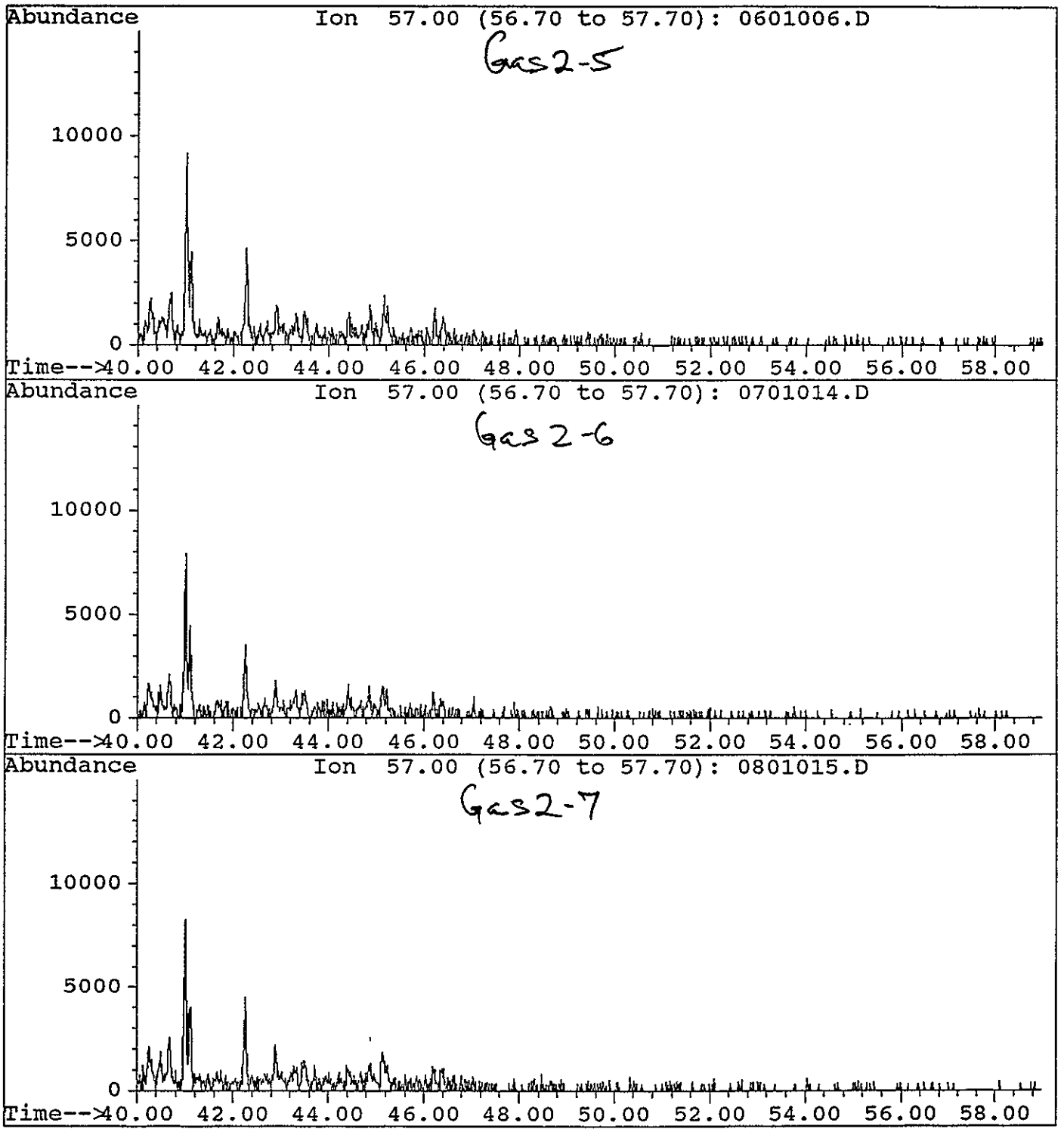
File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8



File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8



File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8



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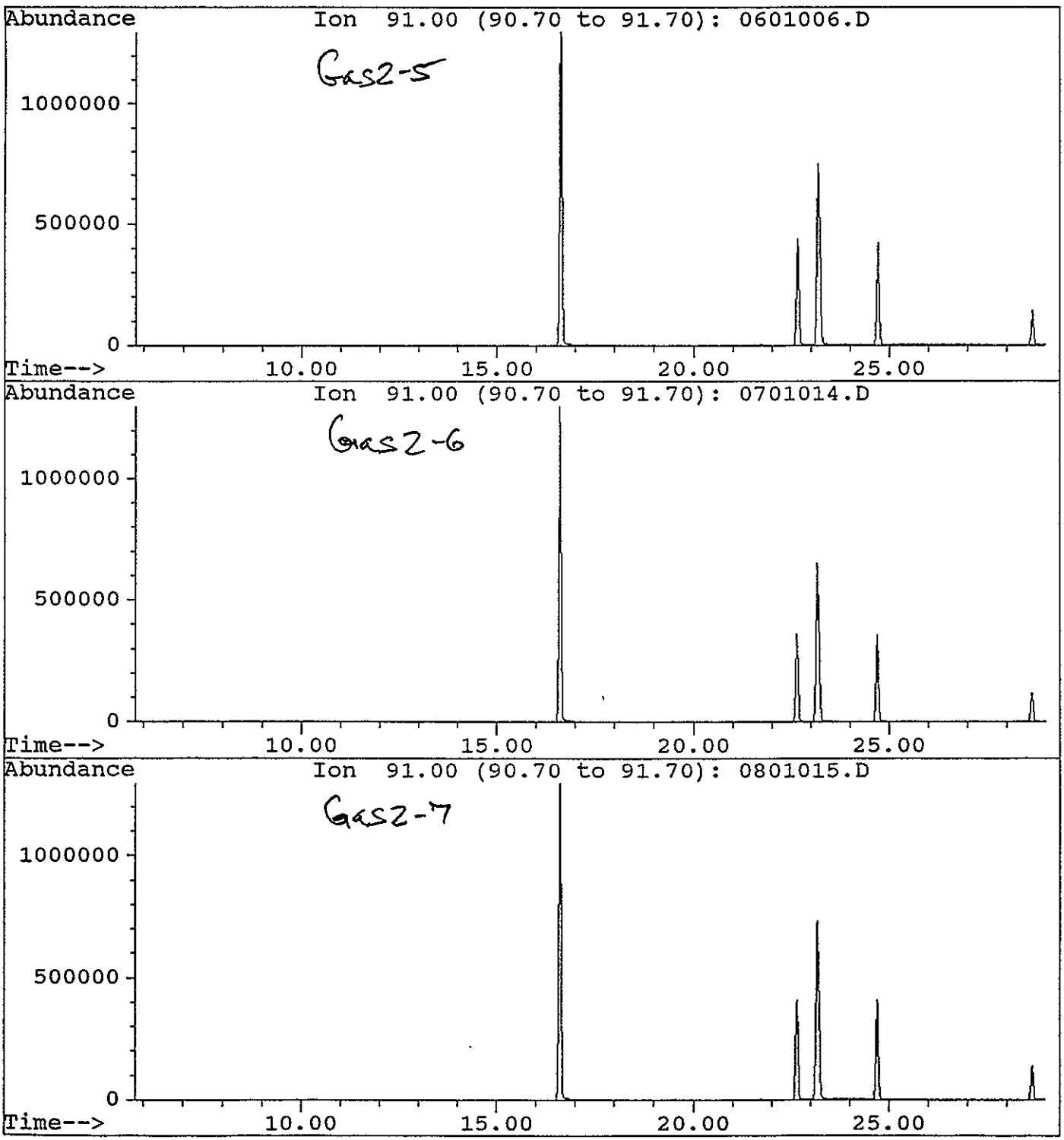
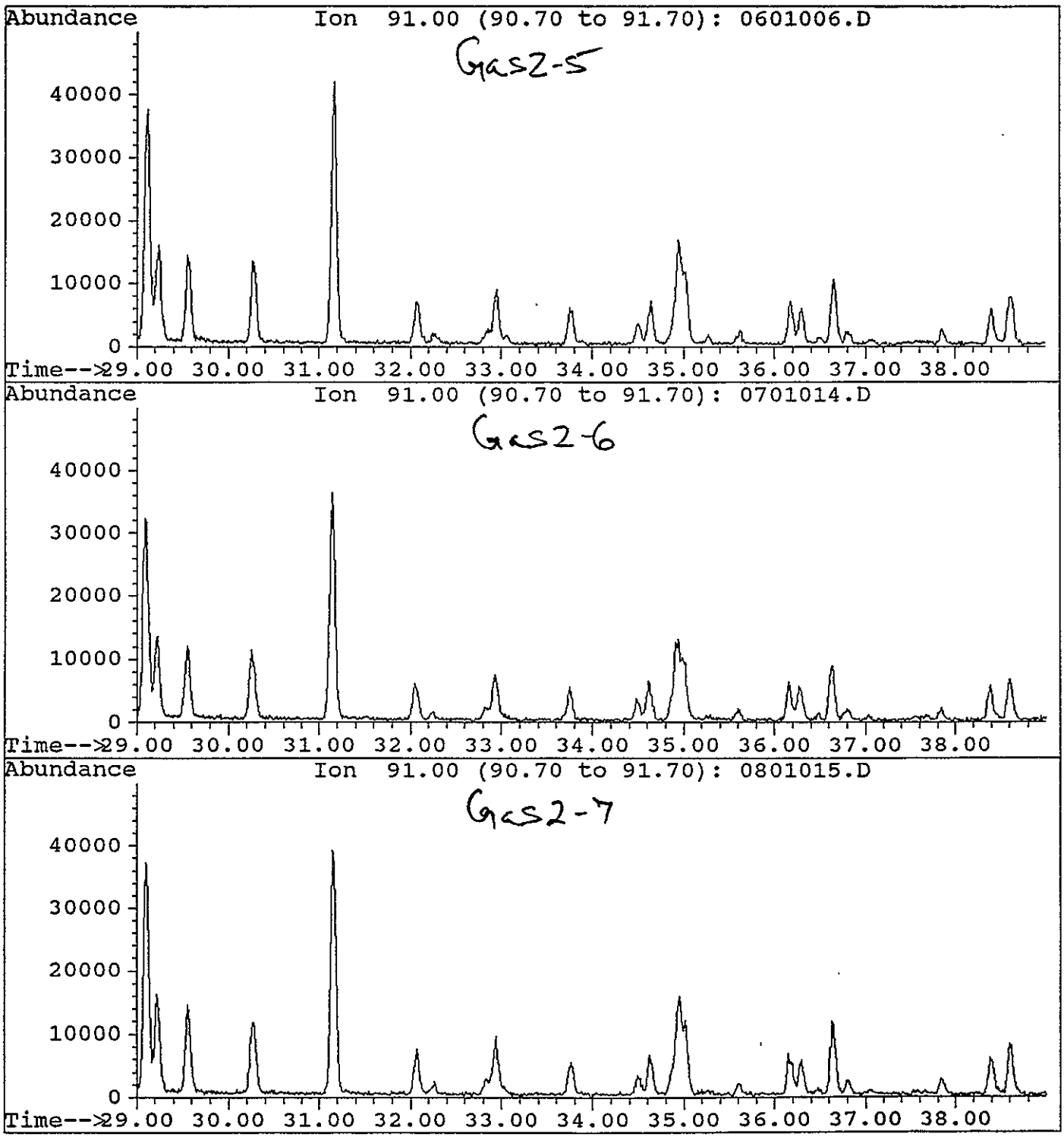
m/e 91
Aromatics

File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8

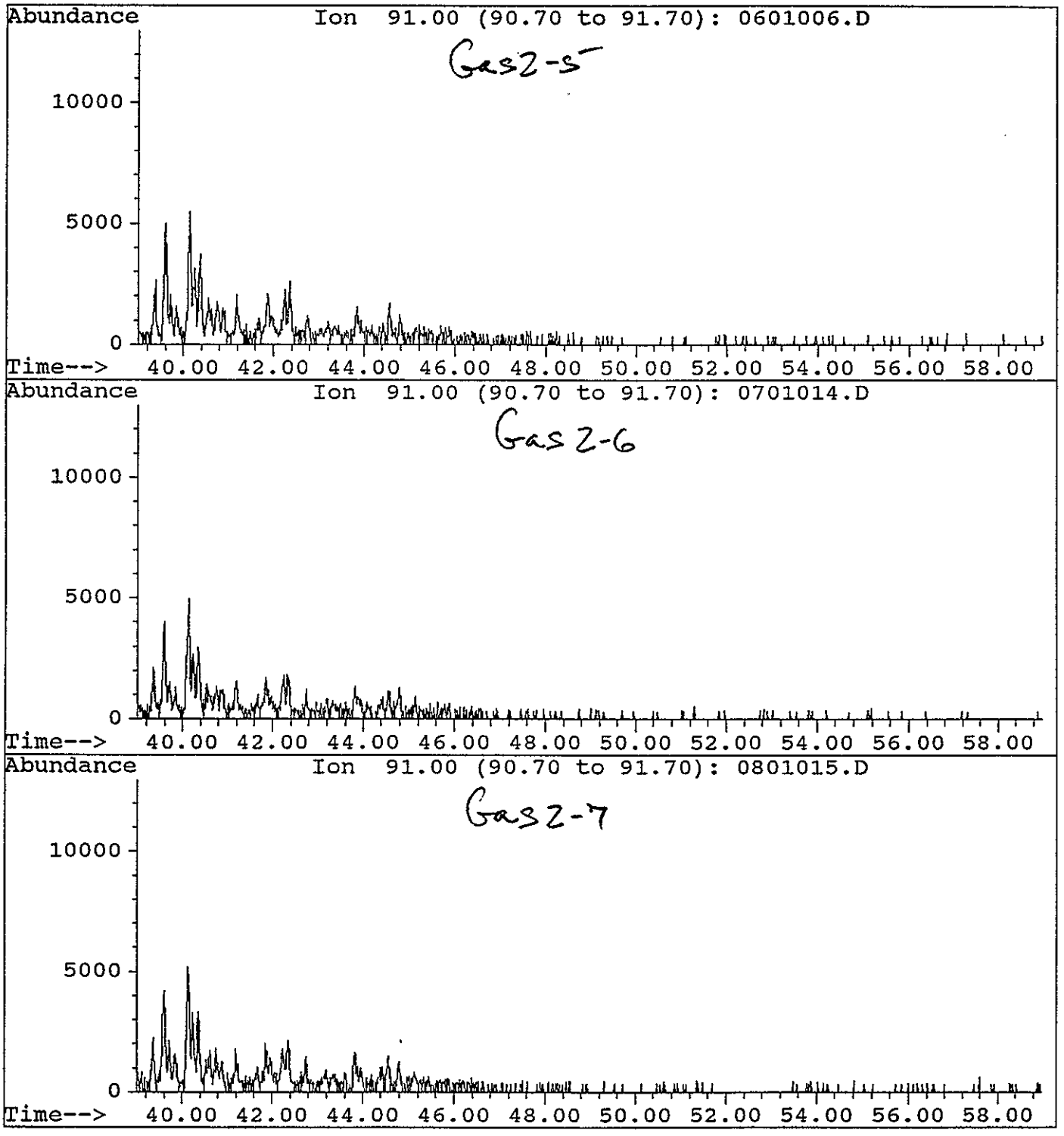


A-44

File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8

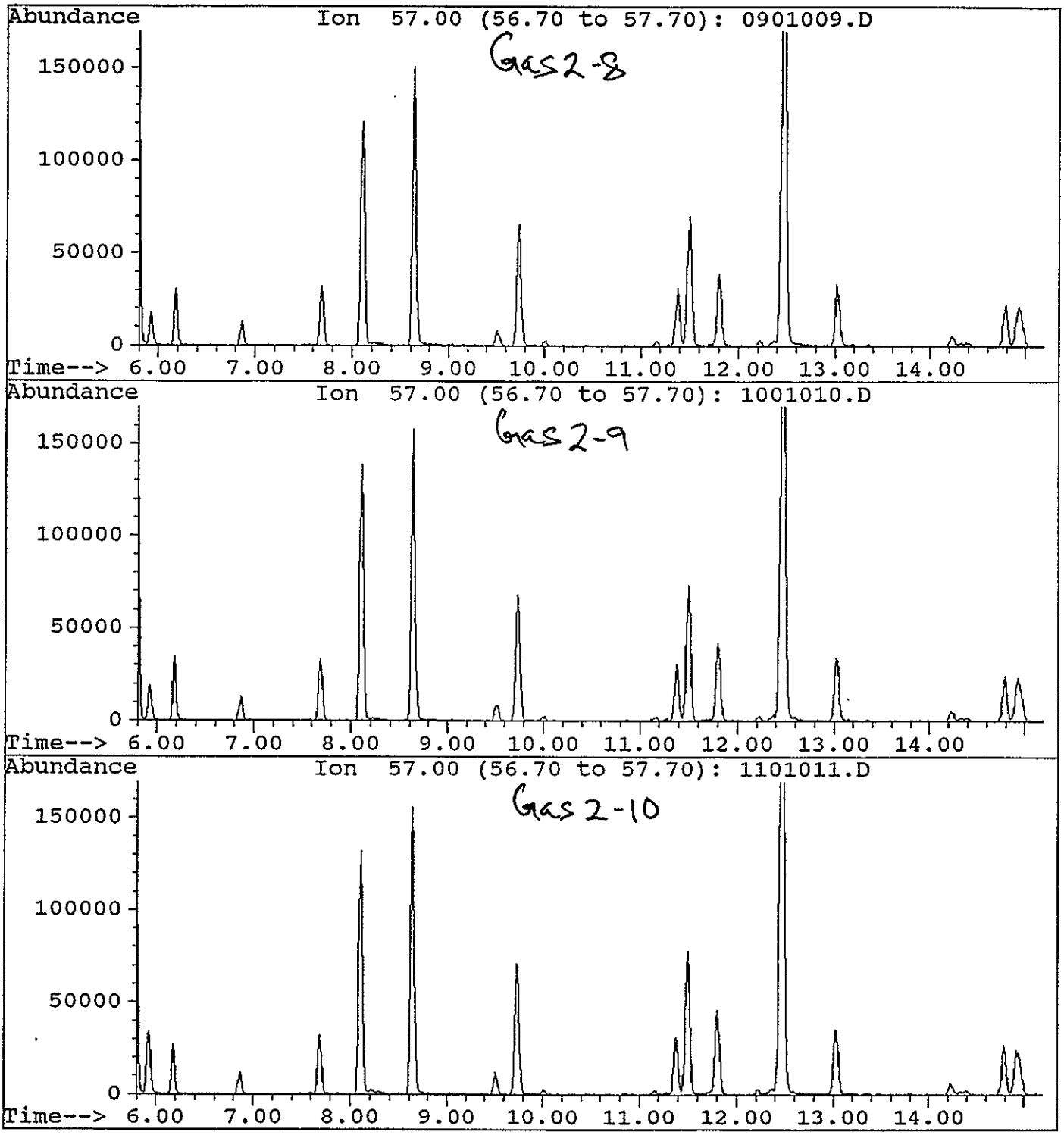


File : C:\HPCHEM\1\DATA\RUNGAS\0801015.D
Operator :
Acquired : 14 Jun 97 9:17 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-7, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 8

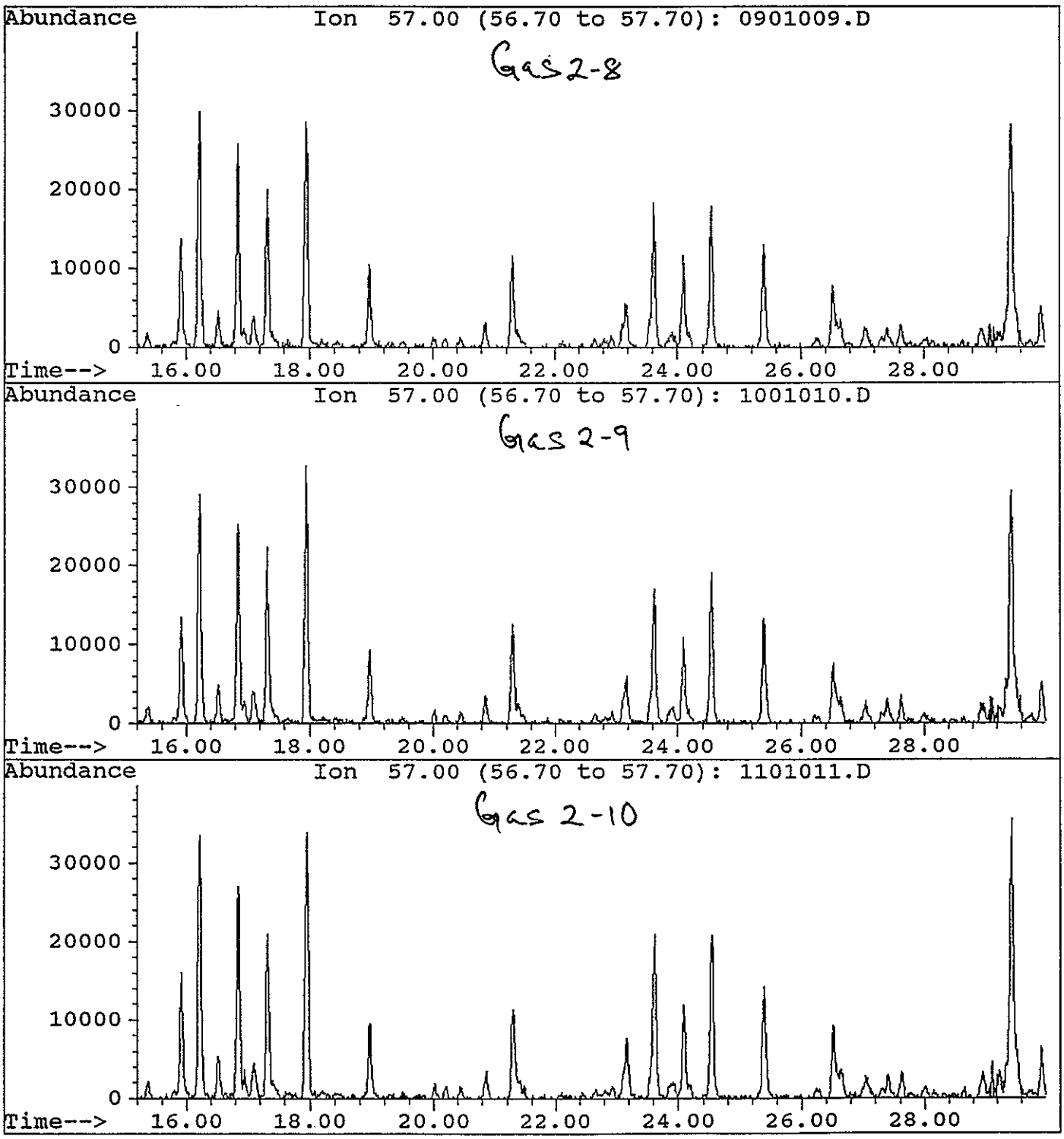


m/e 57
Alkanes

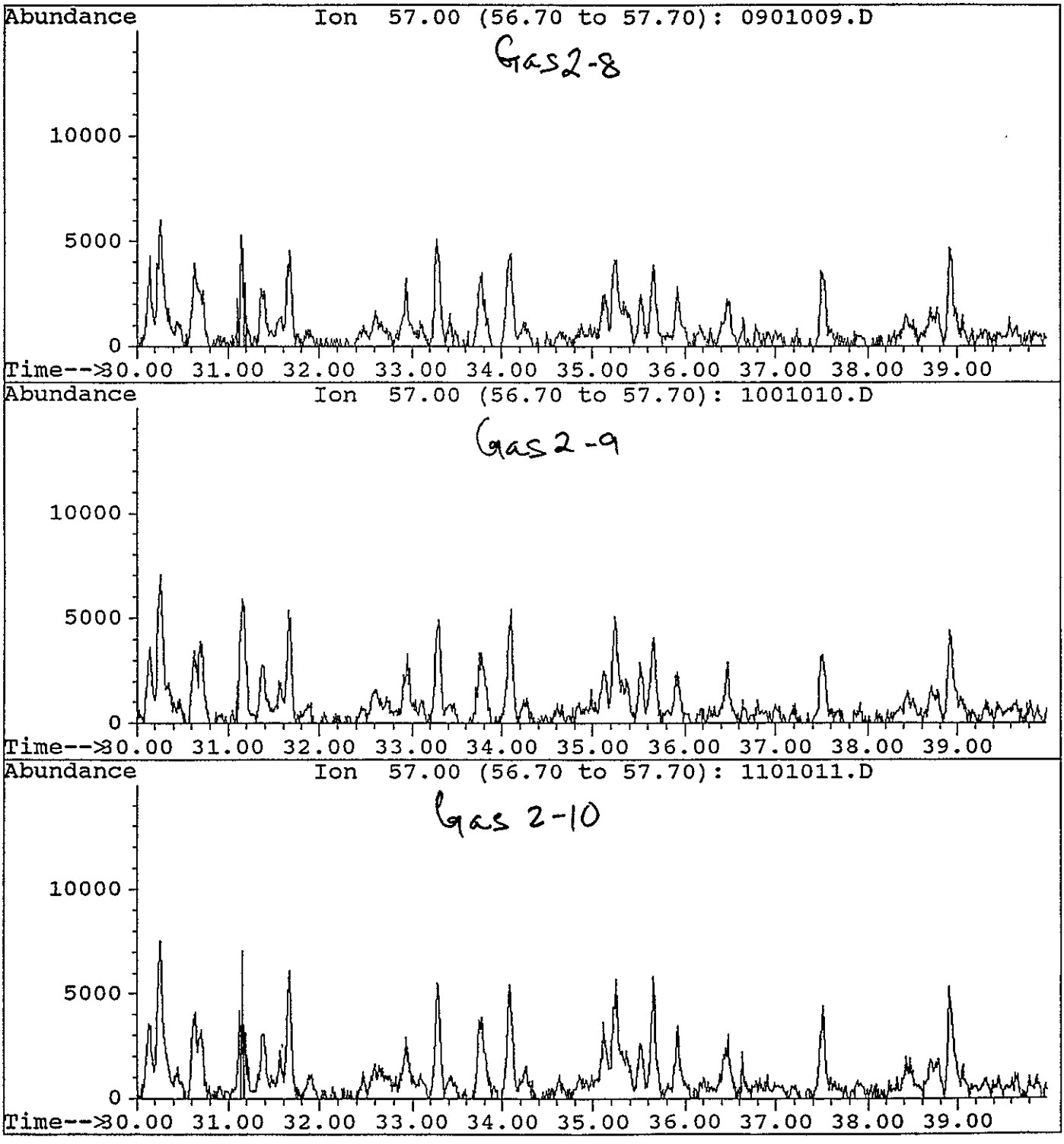
File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11



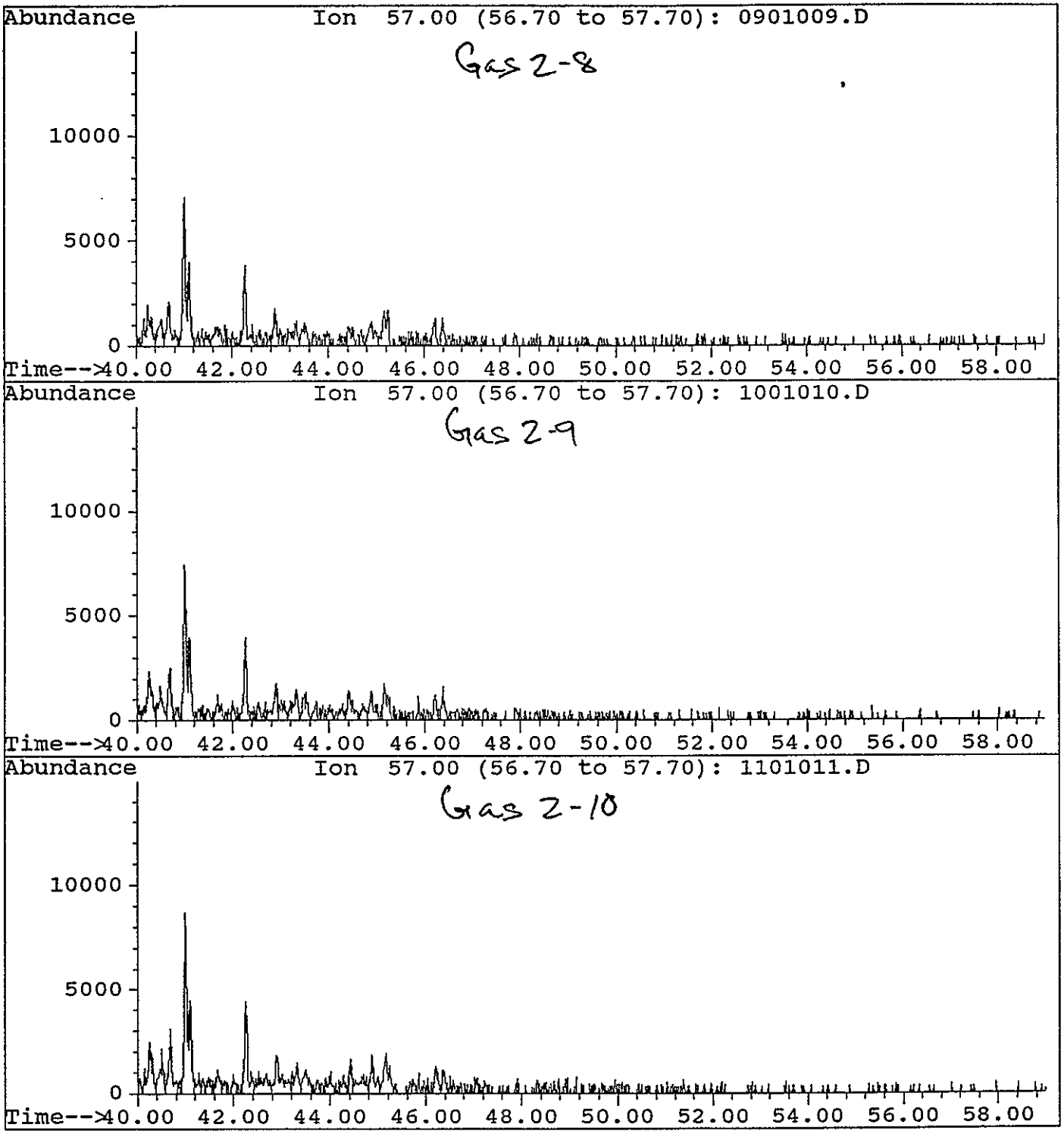
File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11



File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11



File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11



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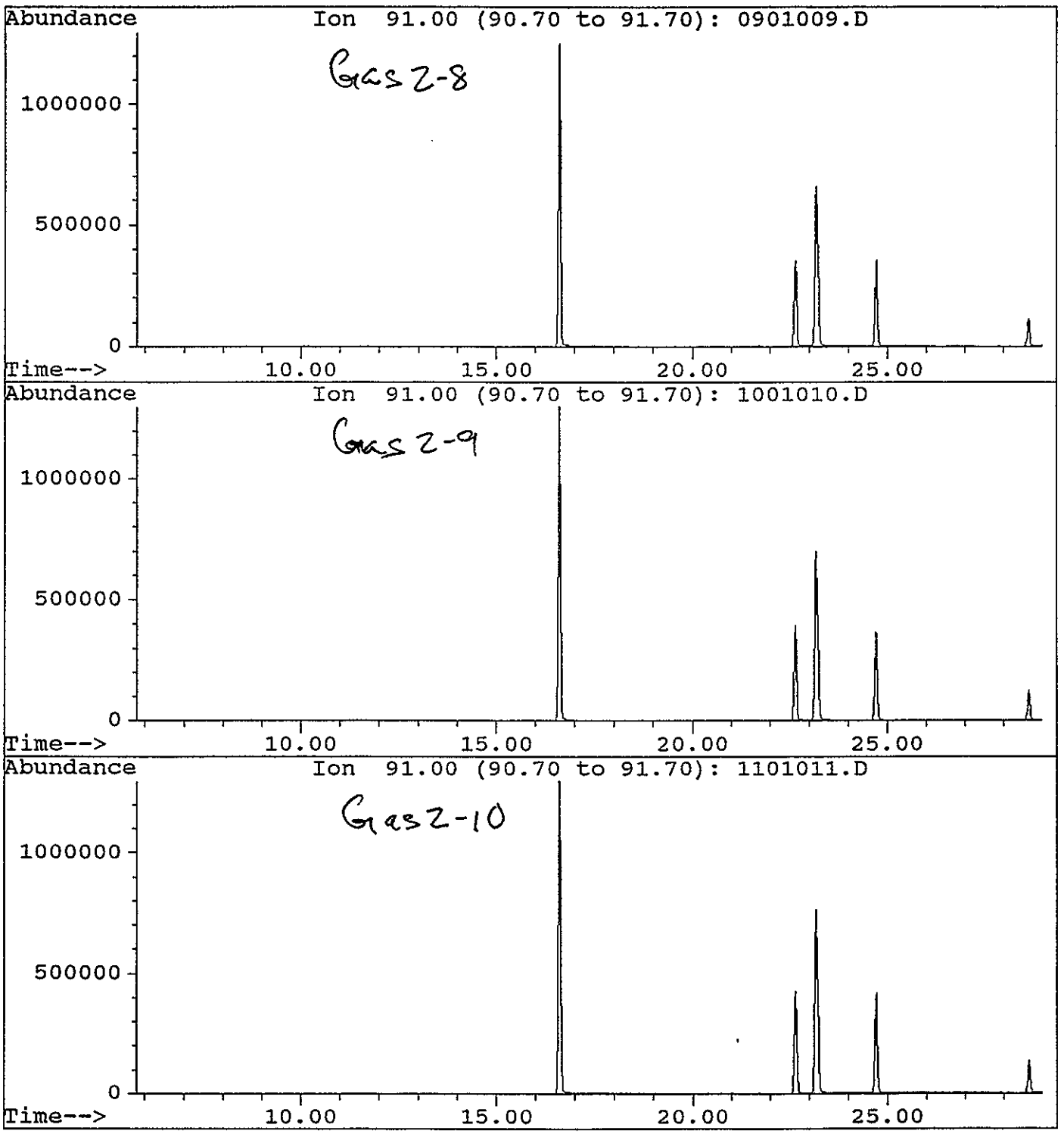
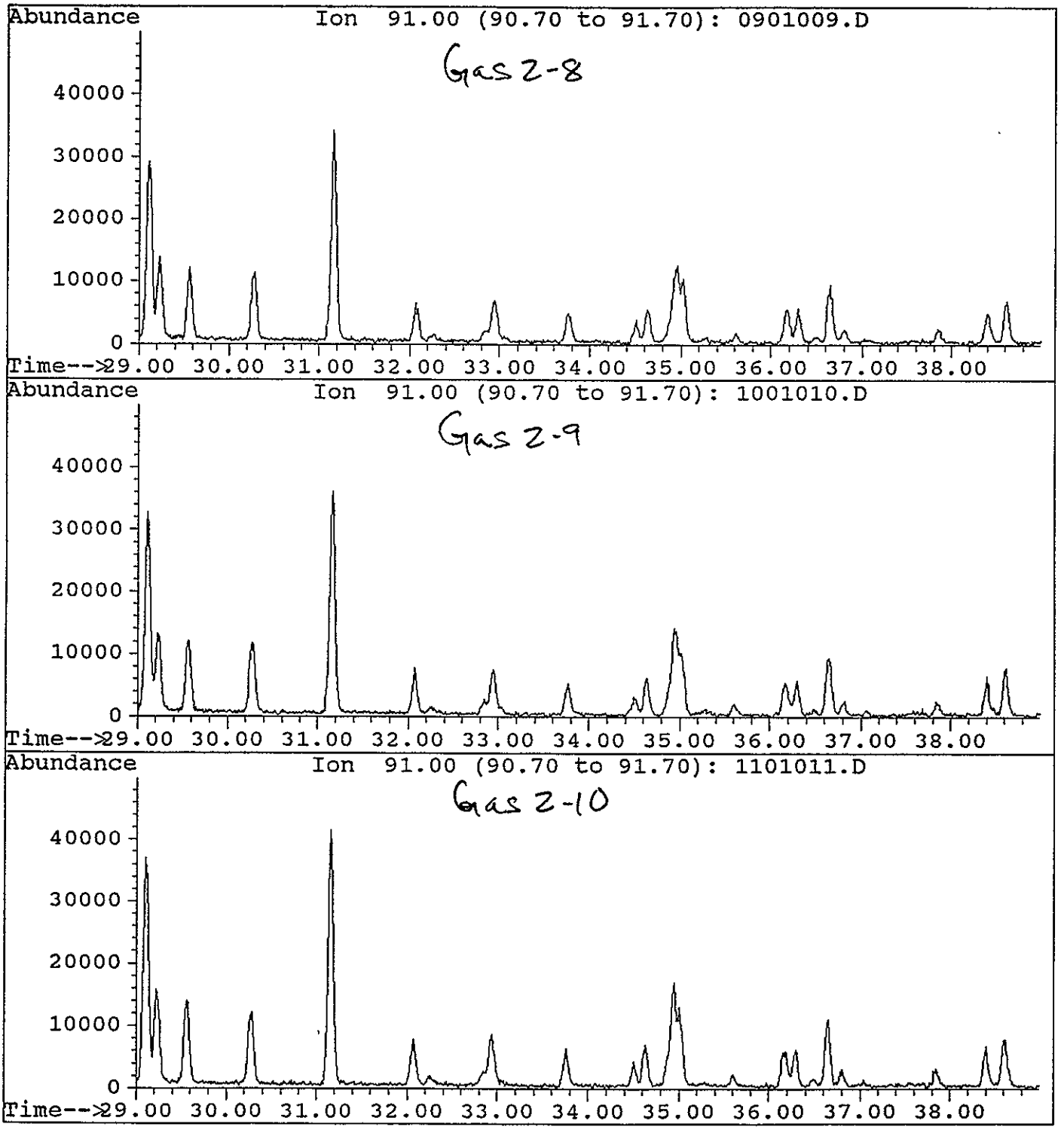
m/e 91
Aromatics

File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11

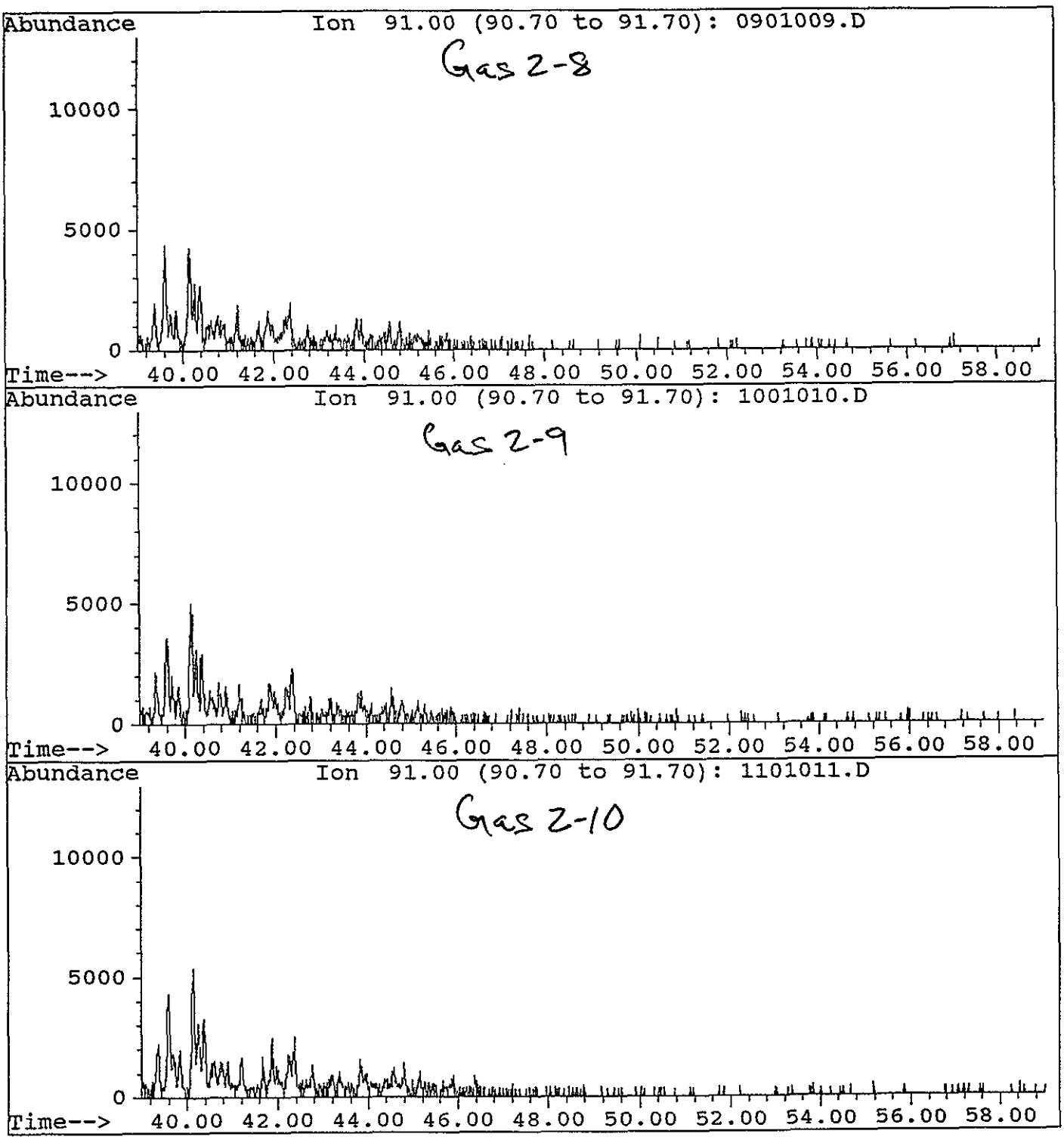


A-51

File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11

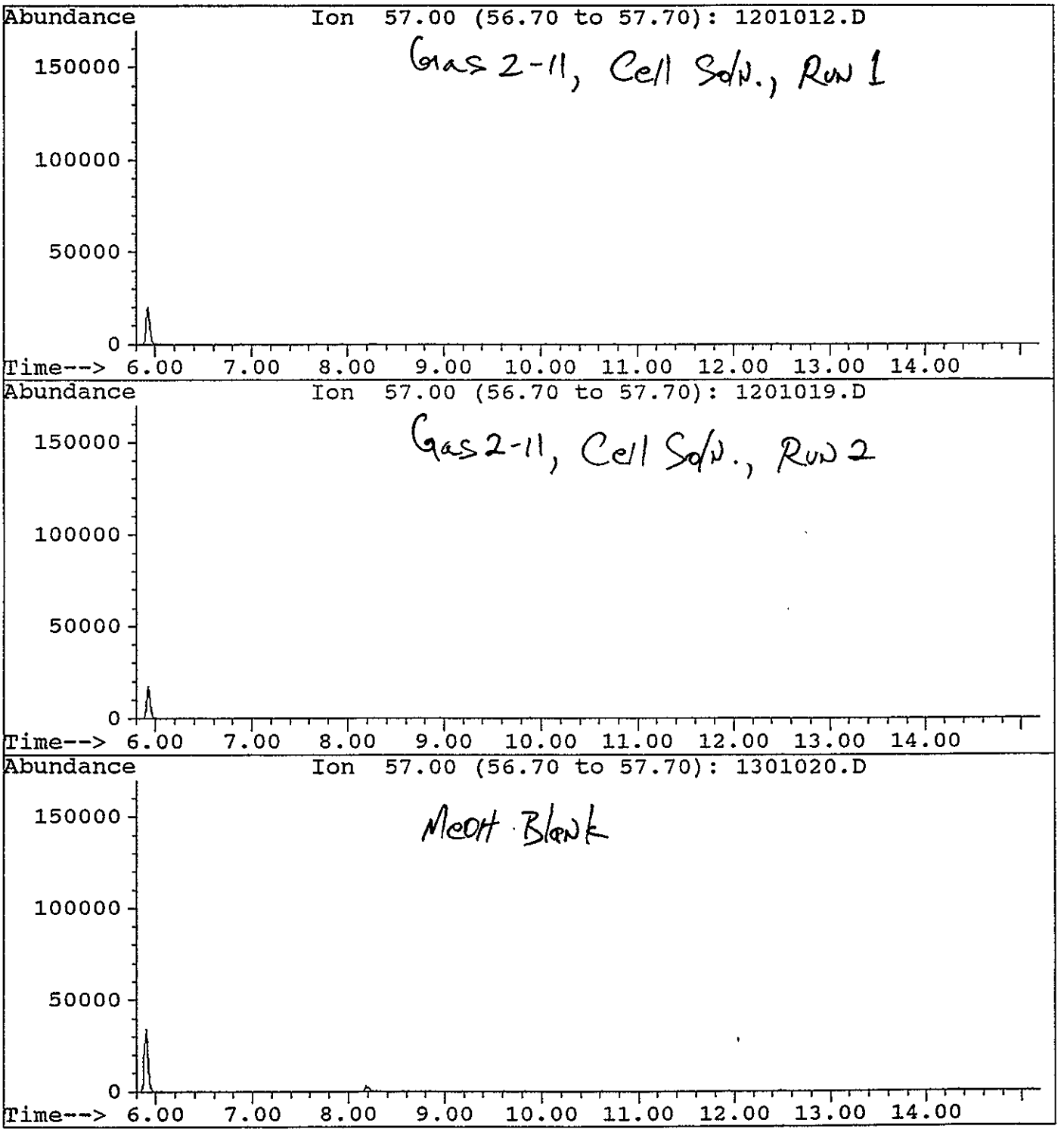


File : C:\HPCHEM\1\DATA\RUNGAS\1101011.D
Operator :
Acquired : 14 Jun 97 4:27 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 11

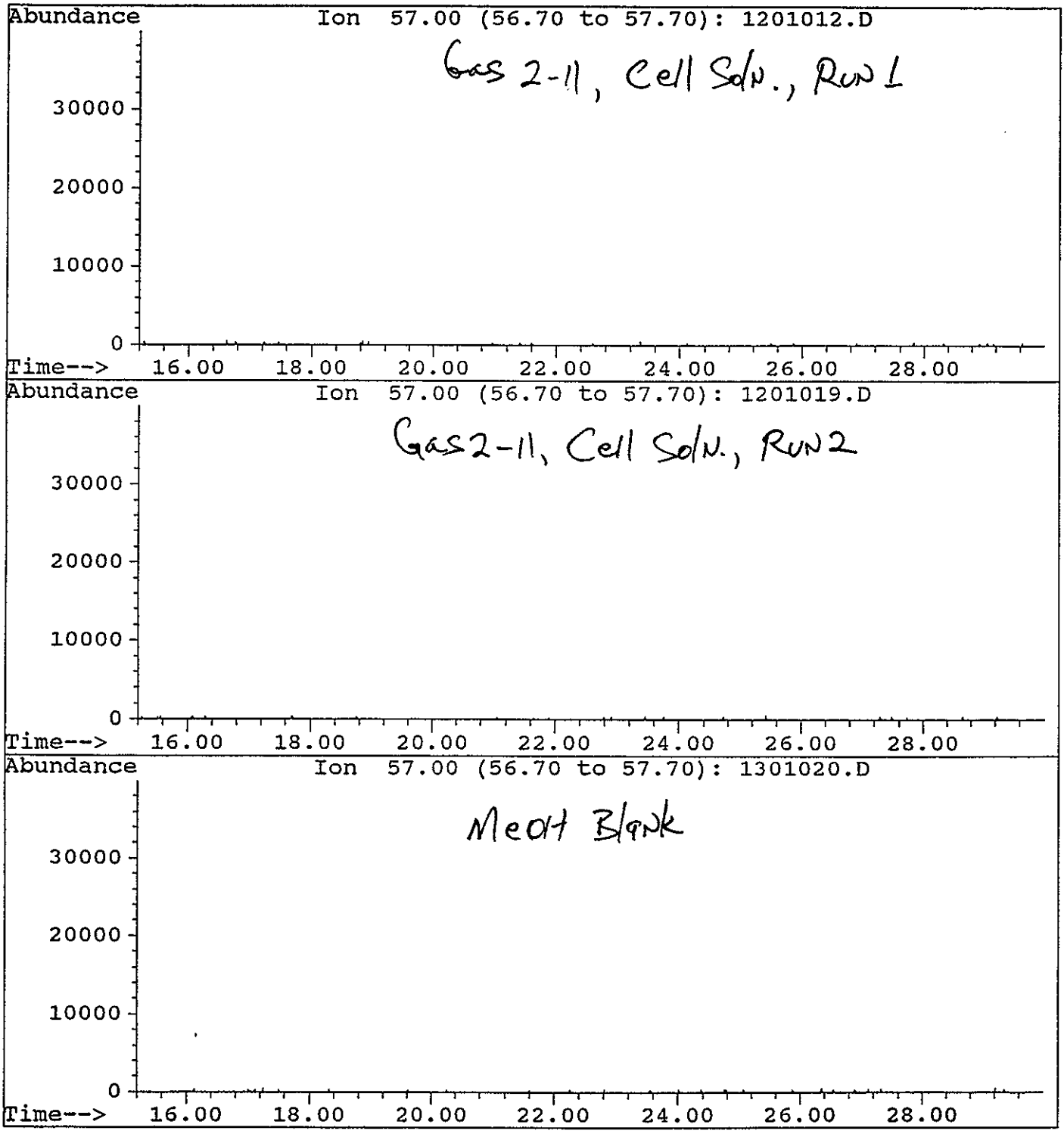


m/e 57
Alkanes

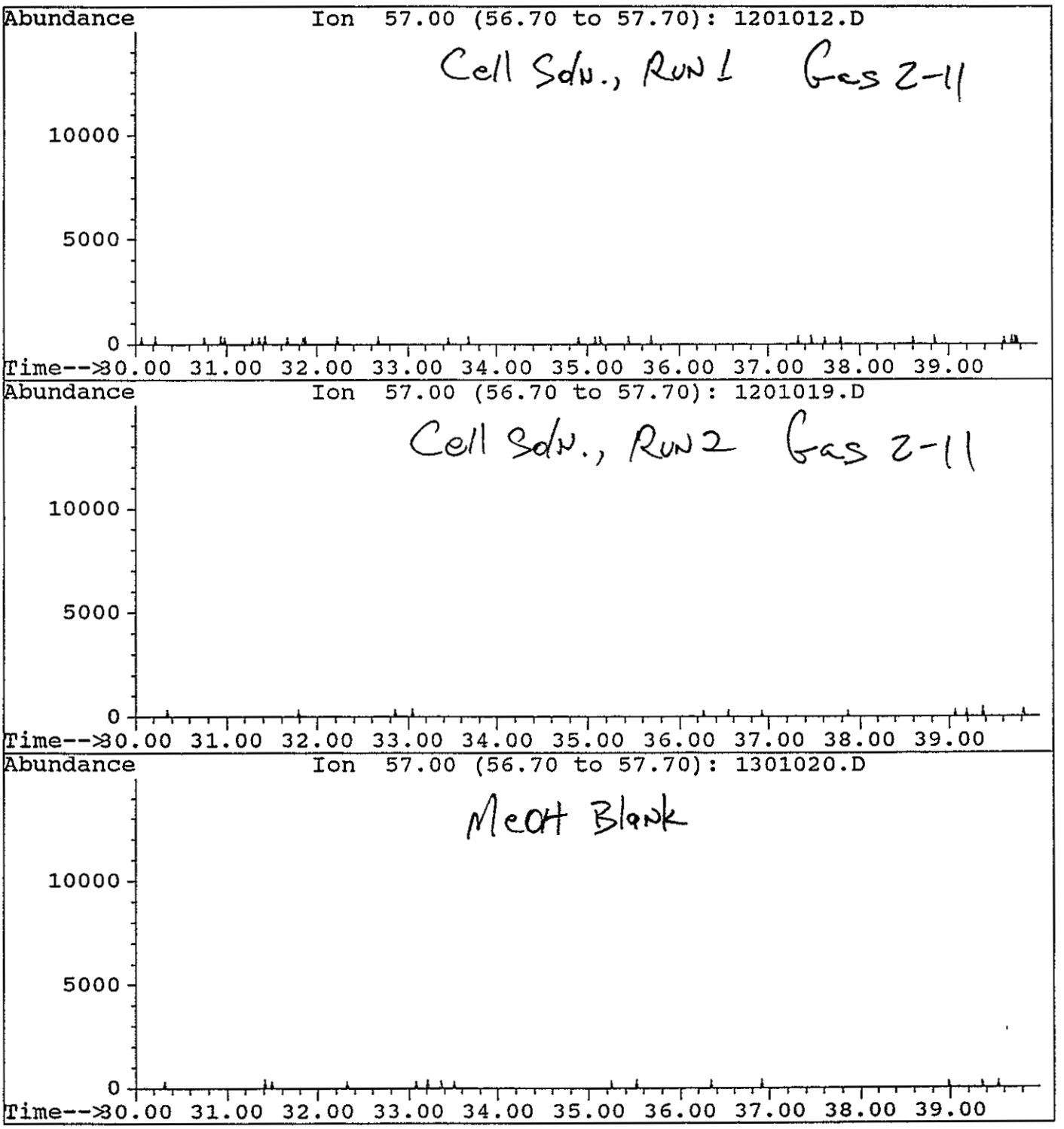
File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



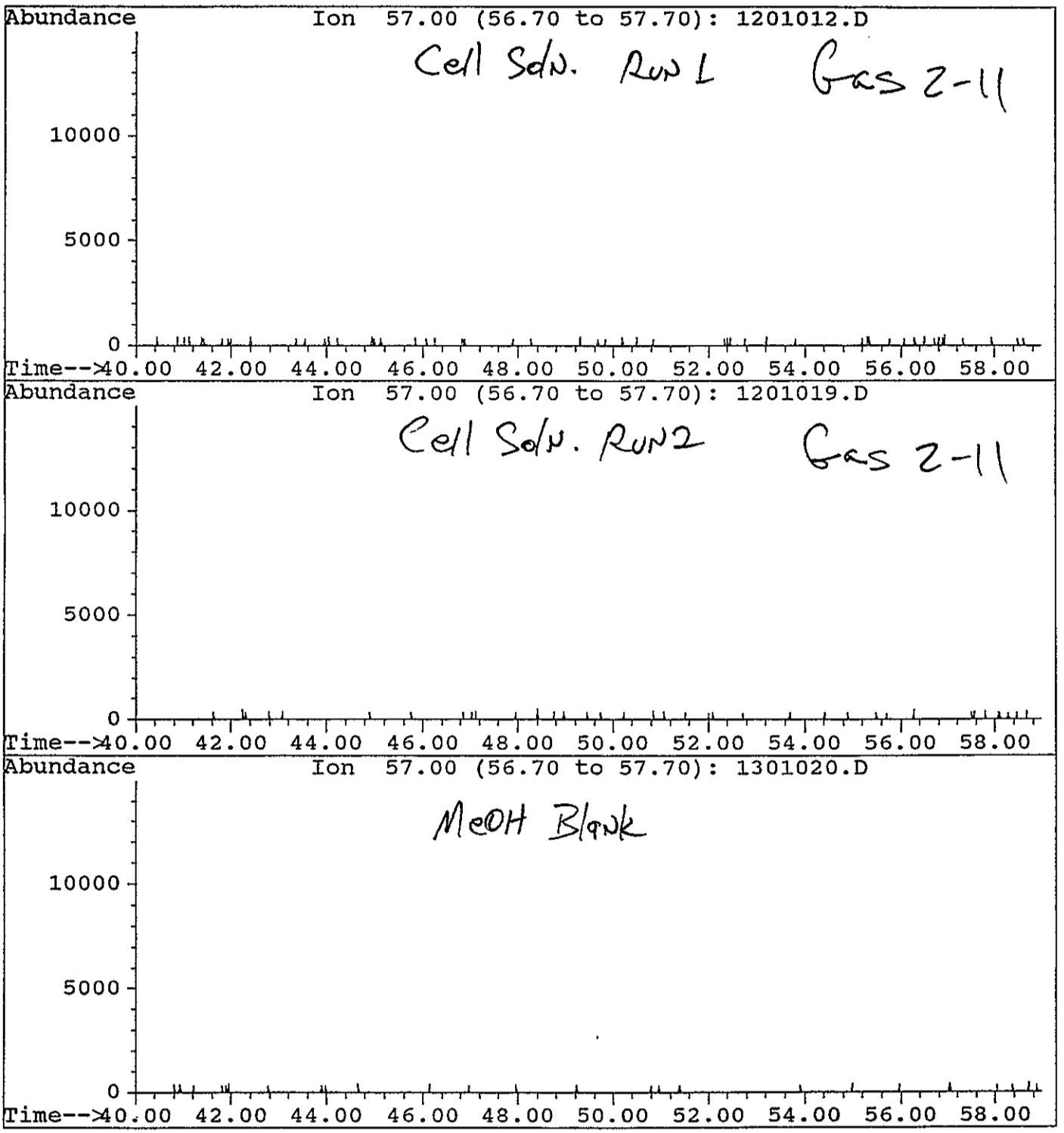
File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



m/e 91
Aromatics

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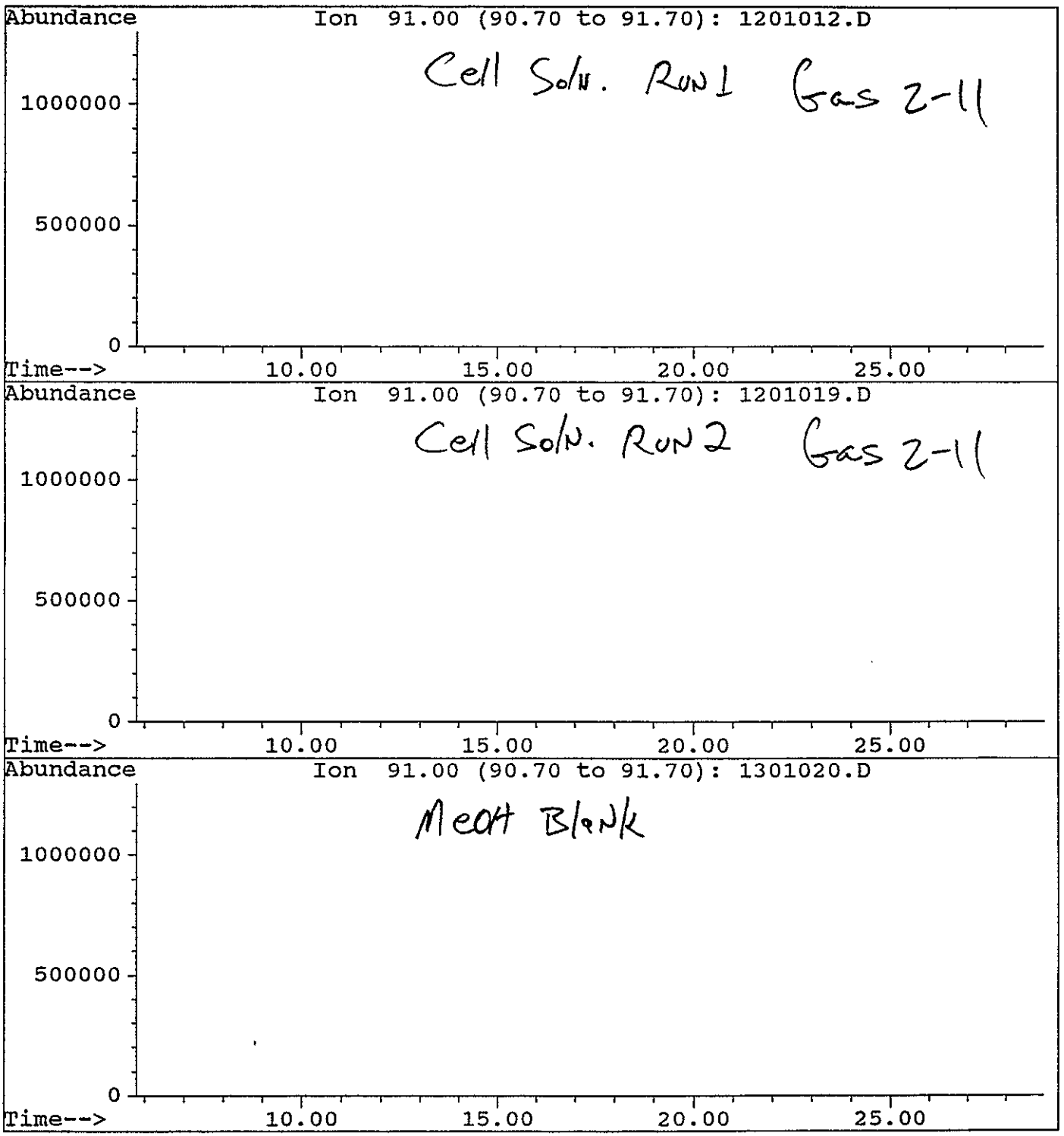
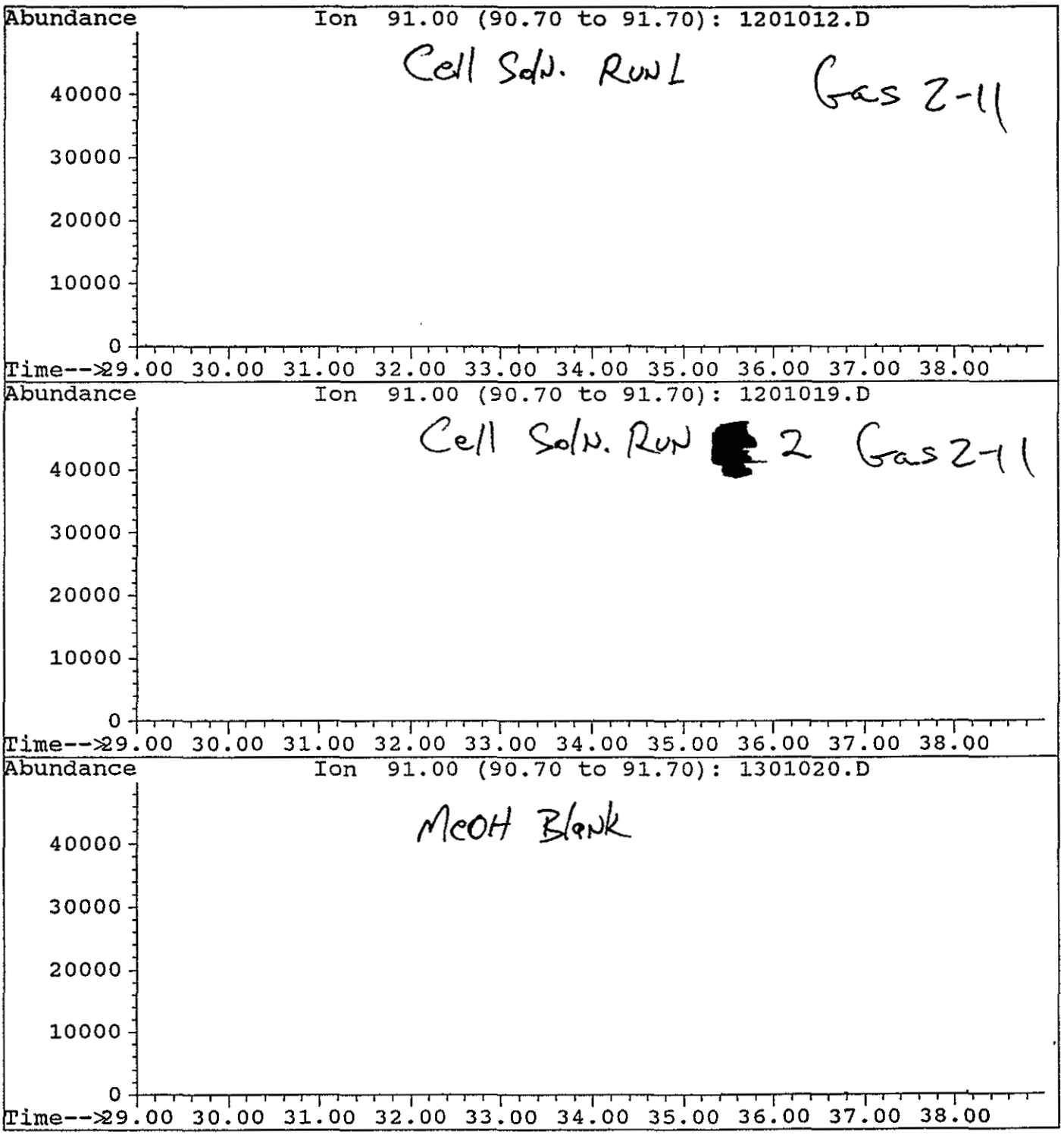
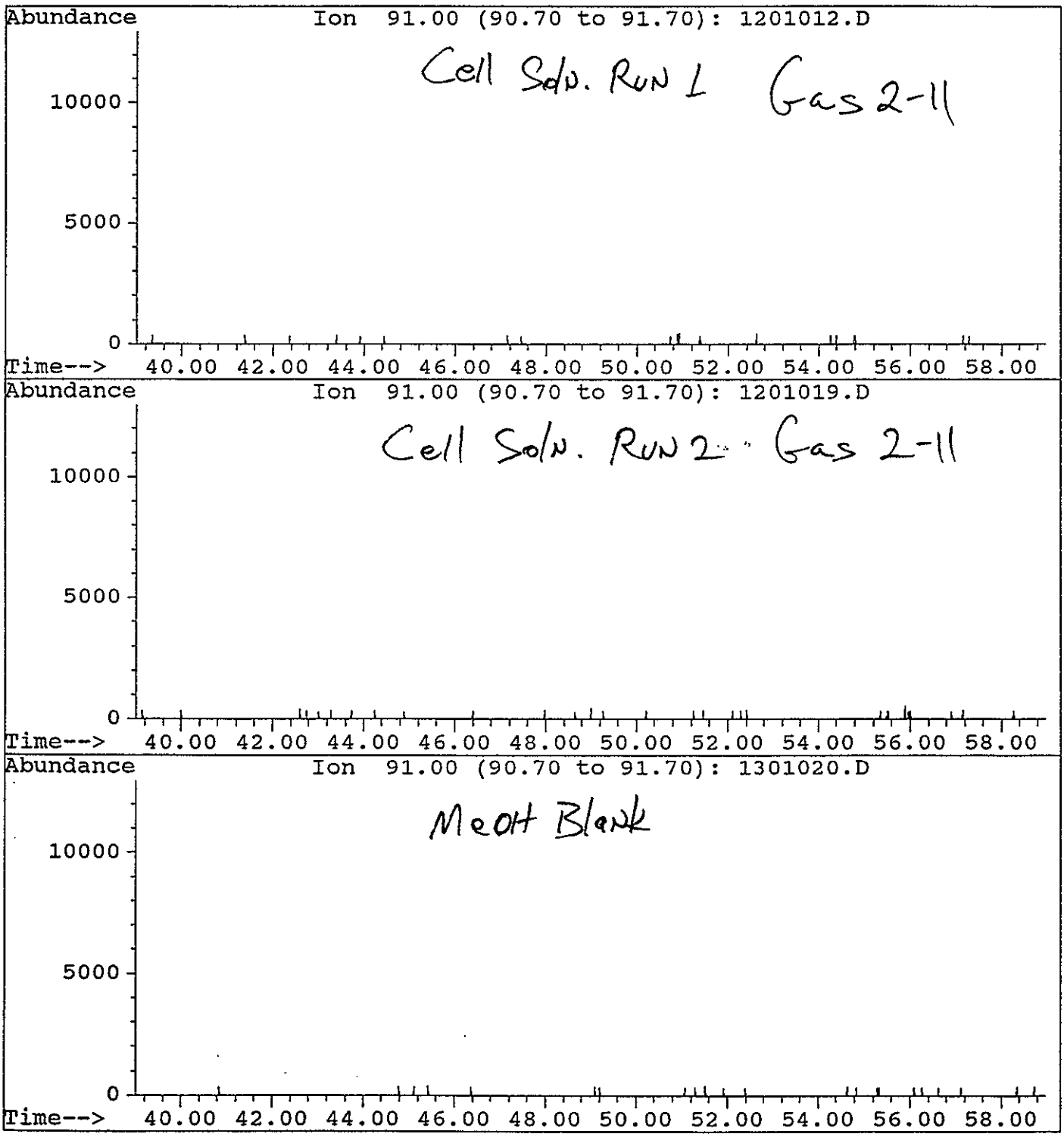
File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



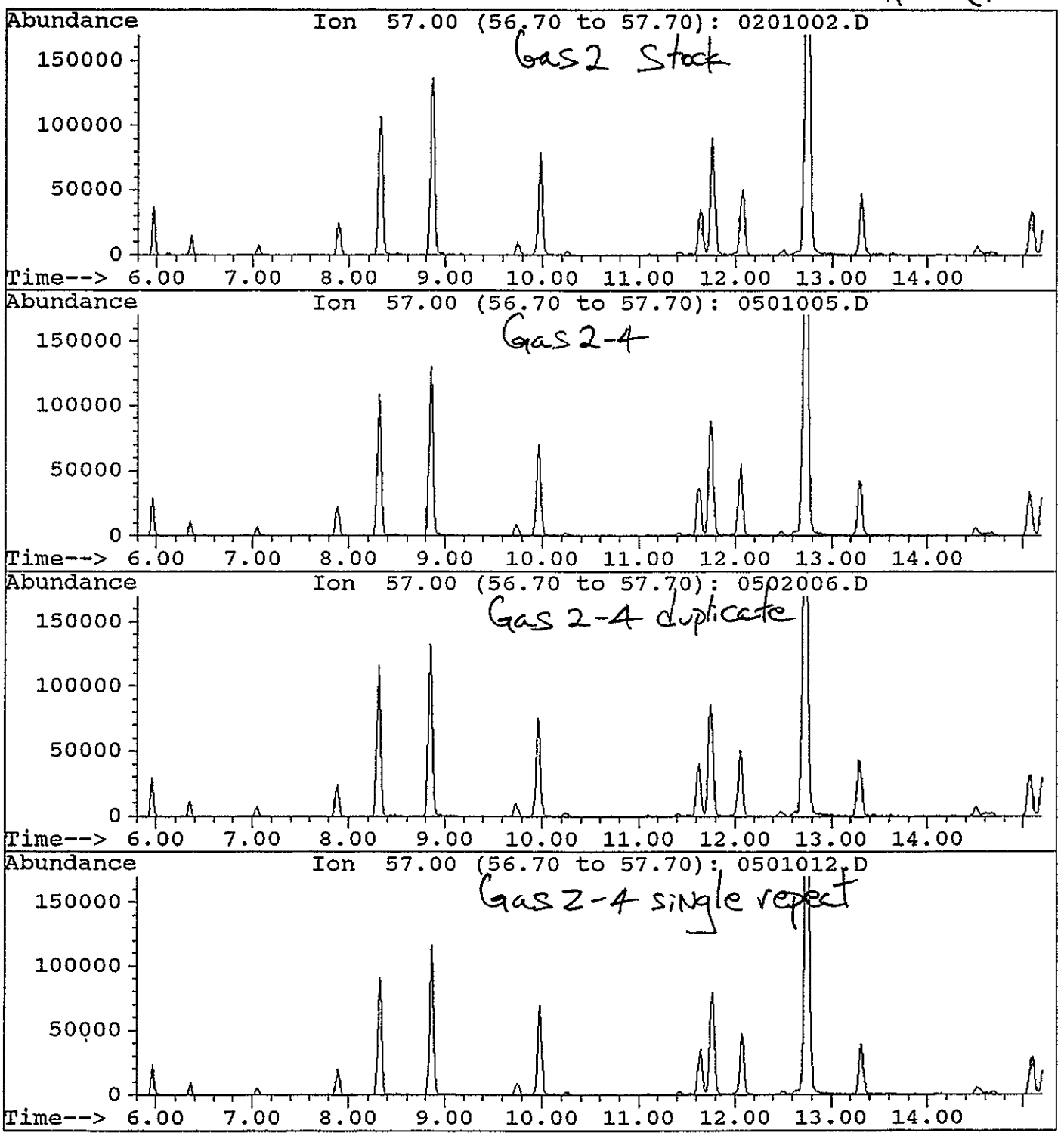
File : C:\HPCHEM\1\DATA\RUNGAS\1301020.D
Operator :
Acquired : 14 Jun 97 3:18 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: MeOH Blank 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 13



Sample Gas2-4. Duplicate instrumental runs followed by repeat single run after instrument had been running other gasoline samples for 7 hours.

File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5

m/e 57 Non-aromatics (Alkanes)



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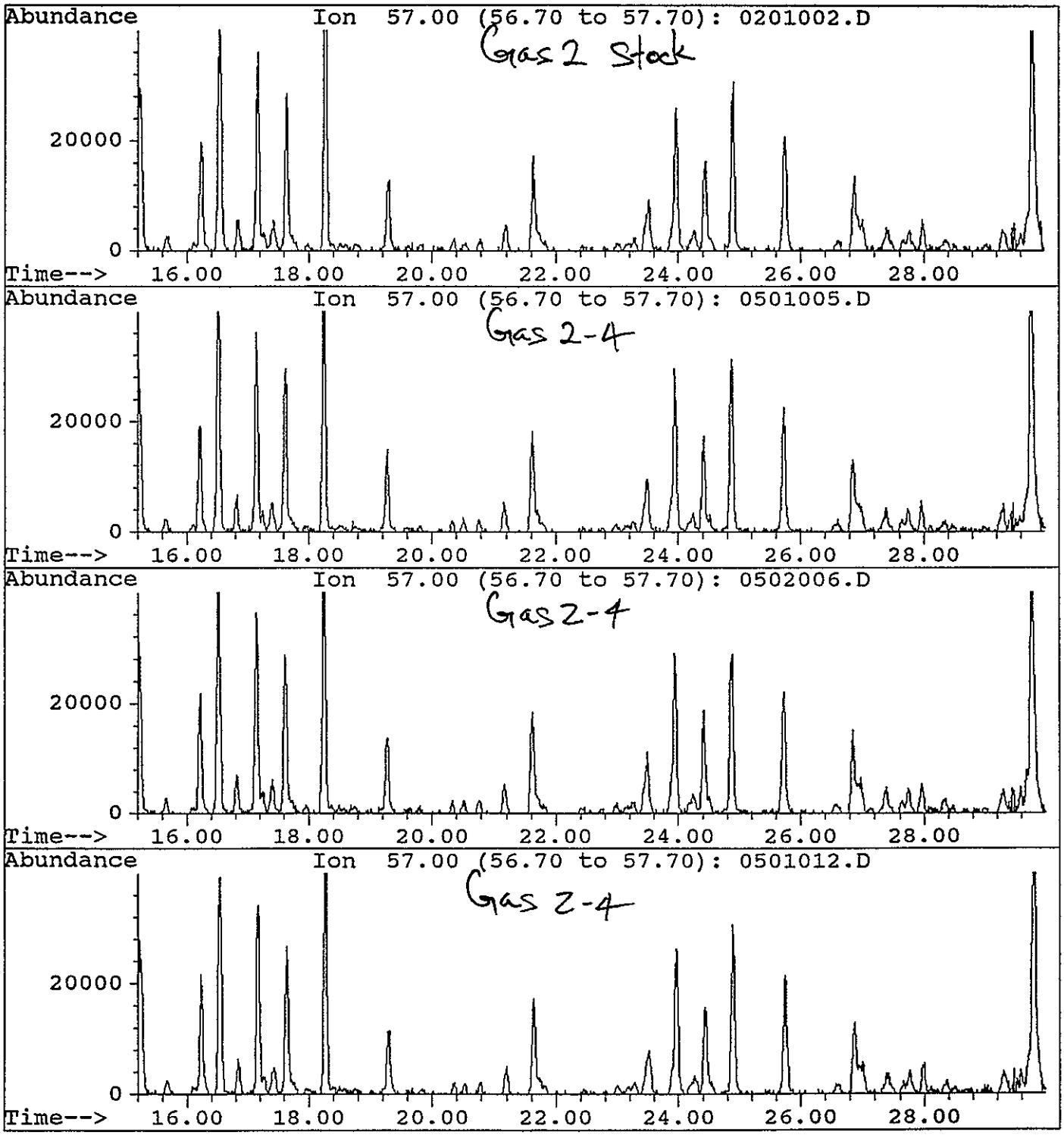
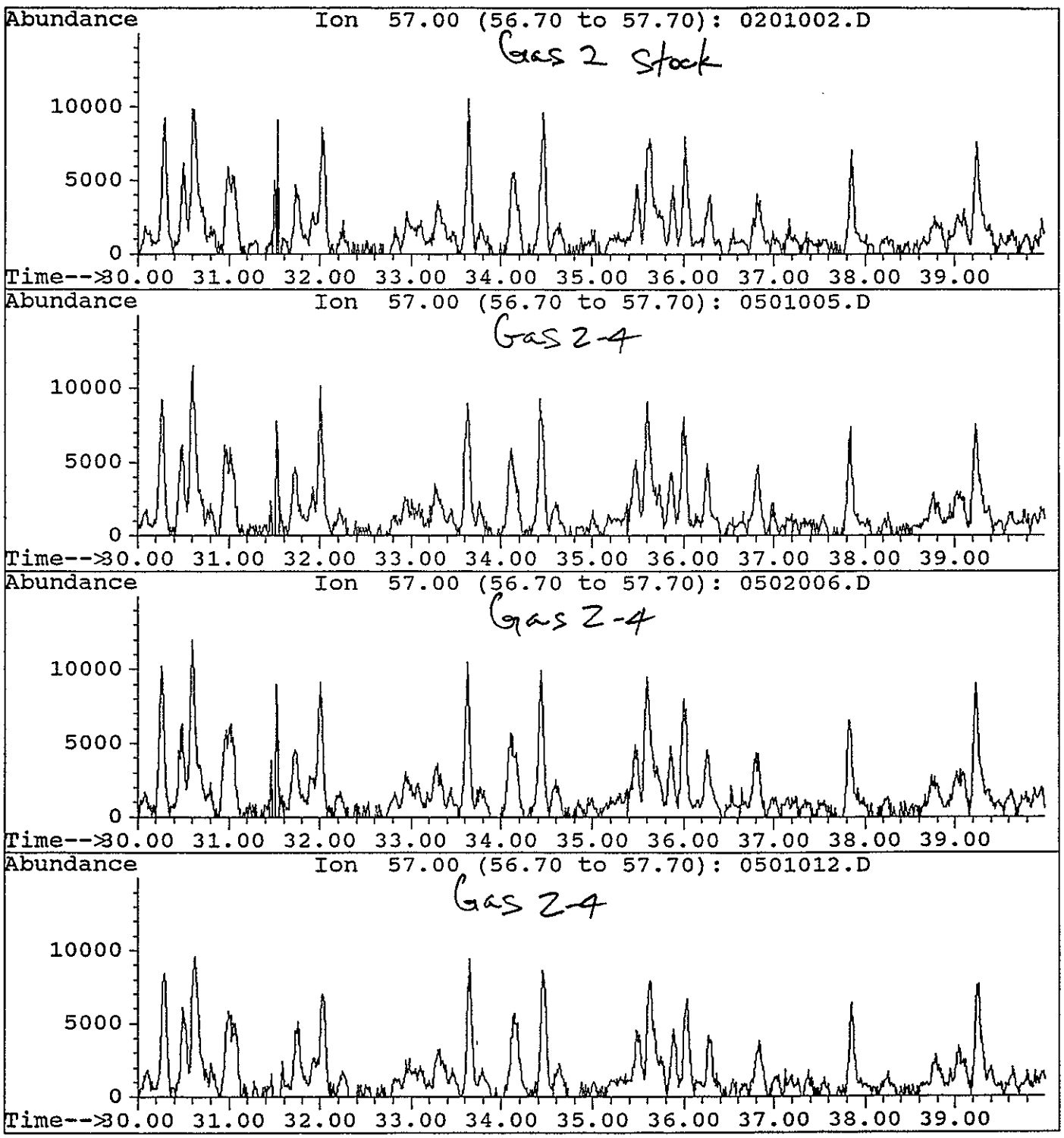
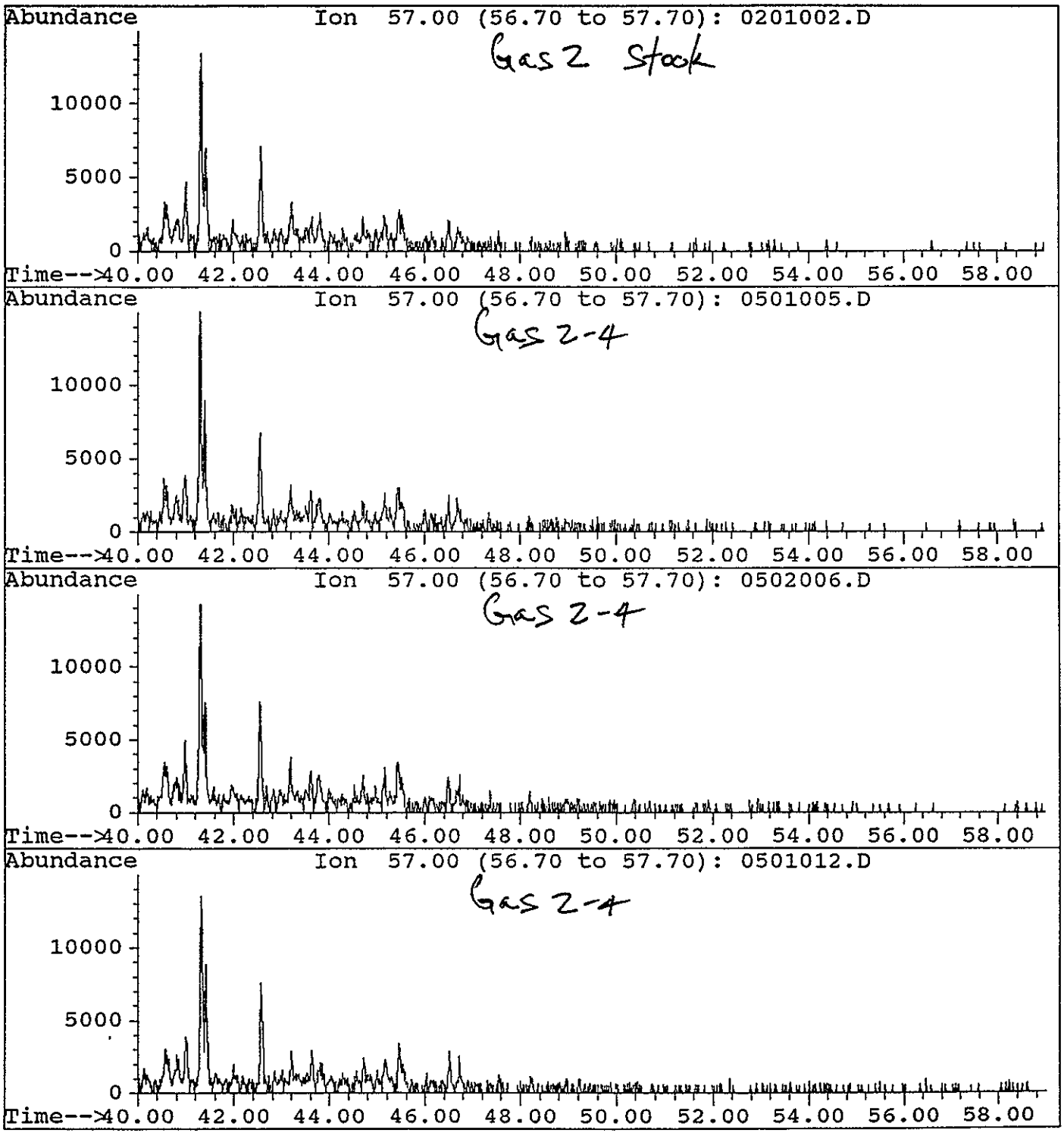
File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5



File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5

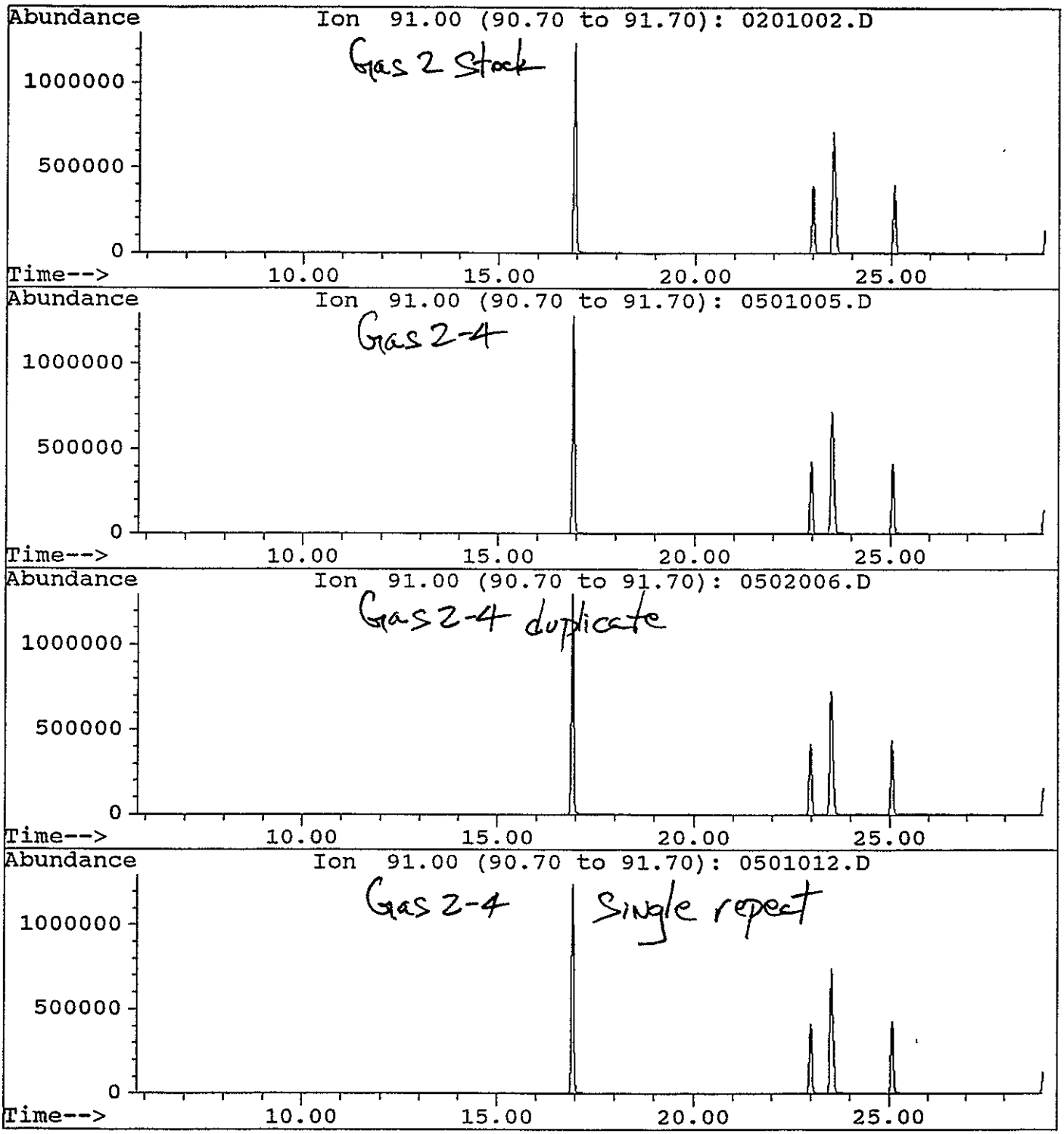


File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5

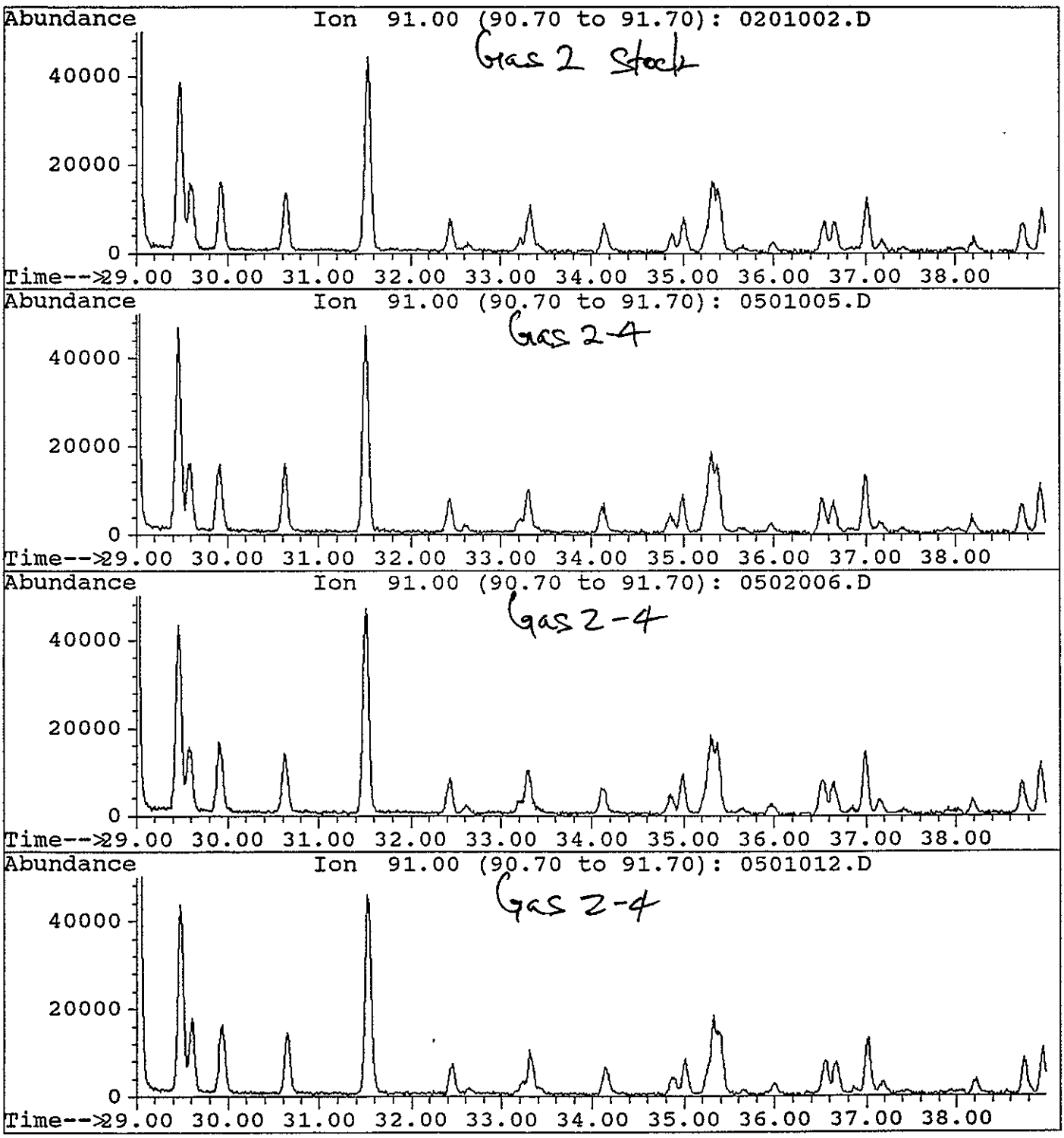


File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5

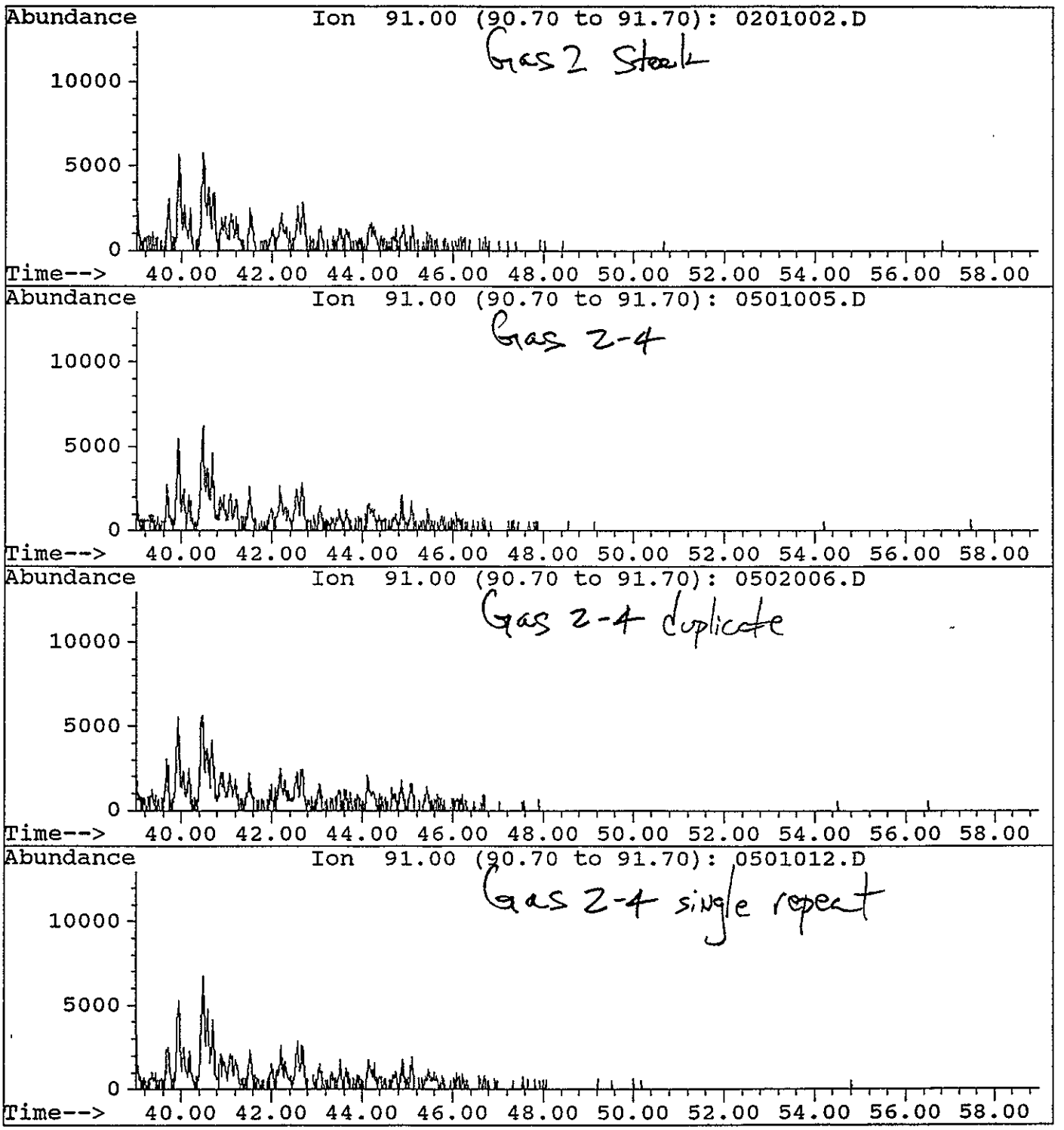
m/e 91
Aromatics



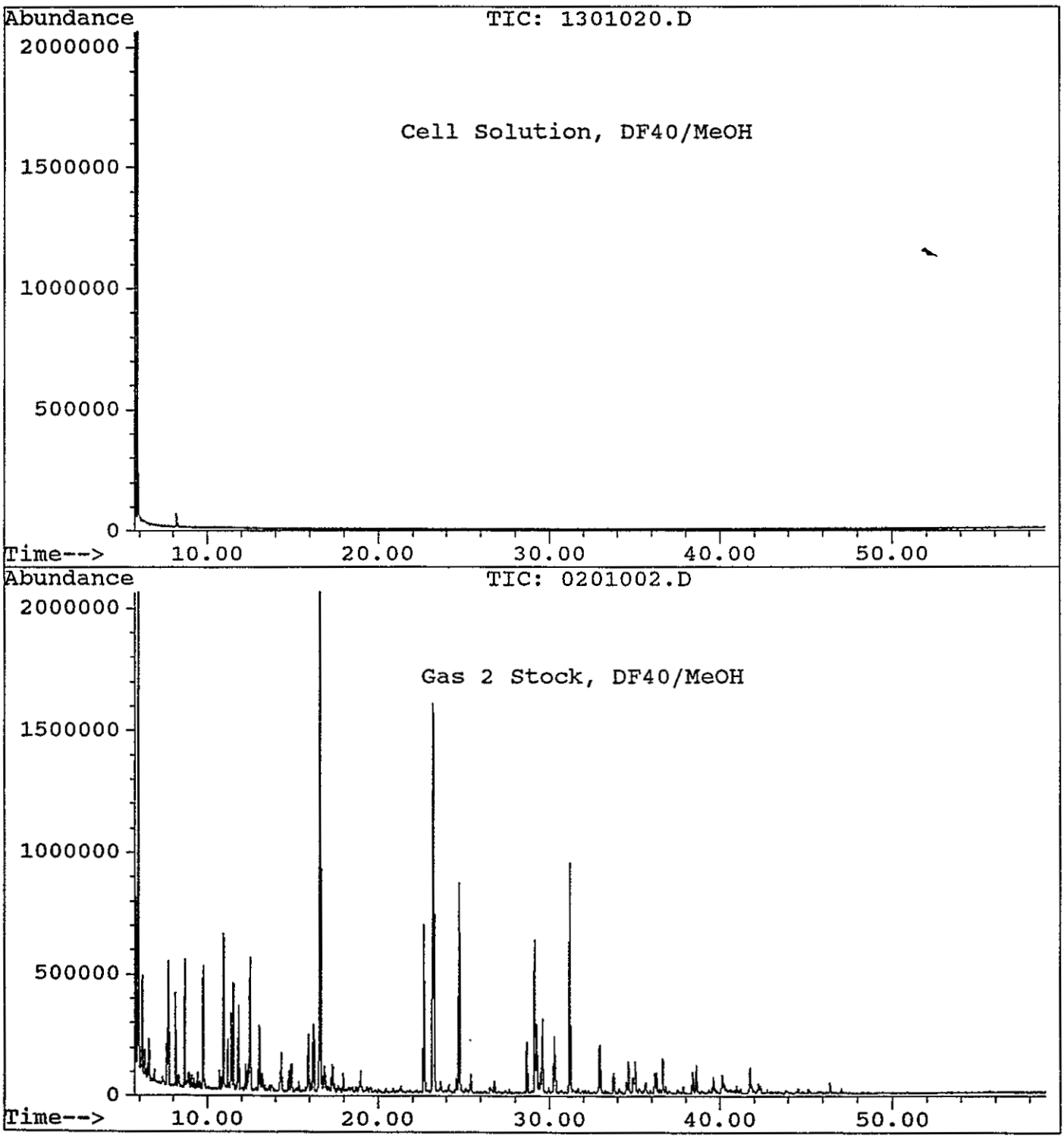
File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5



File : C:\HPCHEM\1\DATA\RUNGAS2\0501012.D
Operator : dls
Acquired : 21 Jun 97 3:46 am using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2-4, 6/8/97 DF40 MeOH 1uL
Misc Info : H18 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 5



File : C:\HPCHEM\1\DATA\RUNGAS2\BLANK2.D
Operator : dls
Acquired : 21 Jun 97 12:30 pm using AcqMethod SCAN2
Instrument : 5971 - In
Sample Name: MeOH Blank
Misc Info : H18 S45 inj250ms270 37Init7/250 .5uL
Vial Number: 15



m/e 57, Non-aromatics
Total Integrations

0201002
m/e 57

Ion 57.00 (56.70 to 57.70): 0201002.D
GAS2 STOCK (fresh) DF40 MeOH

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	48300211	5.754	5 8.944

Ion 57.00 (56.70 to 57.70): 0301003.D
GAS2-2, 6/7/97 DF40 MeOH Bi-Ph 32/10

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	52023541	5.754	5 8.944

Ion 57.00 (56.70 to 57.70): 0401004.D
GAS2-3, 6/8/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	50744362	5.754	5 8.953

Ion 57.00 (56.70 to 57.70): 0601006.D
GAS2-5, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	55571175	5.754	5 8.953

Ion 57.00 (56.70 to 57.70): 0701014.D
GAS2-6, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	PH +	0.000	50125398	5.745	5 8.944

Ion 57.00 (56.70 to 57.70): 0801015.D
GAS2-7, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	PH +	0.000	59262375	5.745	5

8.953

Ion 57.00 (56.70 to 57.70): 0901009.D
GAS2-8, 6/9/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	40185276	5.754	5

8.944

Ion 57.00 (56.70 to 57.70): 1001010.D
GAS2-9, 6/10/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	48567099	5.754	5

8.944

Ion 57.00 (56.70 to 57.70): 1101011.D
GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	46917830	5.754	5

8.953

Ion 57.00 (56.70 to 57.70): 1201012.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

Ion 57.00 (56.70 to 57.70): 1201019.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

Ion 57.00 (56.70 to 57.70): 1301020.D
MeOH Blank 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

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m/e 91, Aromatics Total Integrations

Ion 91.00 (90.70 to 91.70): 0201002.D
GAS2 STOCK (fresh) DF40 MeOH

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	138589419	5.754	5 8.944

Ion 91.00 (90.70 to 91.70): 0301003.D
GAS2-2, 6/7/97 DF40 MeOH Bi-Ph 32/10

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	156645720	5.754	5 8.944

Ion 91.00 (90.70 to 91.70): 0401004.D
GAS2-3, 6/8/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	144026835	5.754	5 8.953

Ion 91.00 (90.70 to 91.70): 0601006.D
GAS2-5, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	166300226	5.754	5 8.953

Ion 91.00 (90.70 to 91.70): 0701014.D
GAS2-6, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	144197771	5.754	5 8.944

Ion 91.00 (90.70 to 91.70): 0801015.D
GAS2-7, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	158235886	5.754	5

8.953

Ion 91.00 (90.70 to 91.70): 0901009.D
GAS2-8, 6/9/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	140975082	5.754	5 8.944

Ion 91.00 (90.70 to 91.70): 1001010.D
GAS2-9, 6/10/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.354	BB +	0.000	150437592	5.754	5 8.944

Ion 91.00 (90.70 to 91.70): 1101011.D
GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	32.358	BB +	0.000	166735951	5.754	5 8.953

Ion 91.00 (90.70 to 91.70): 1201012.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

Ion 91.00 (90.70 to 91.70): 1201019.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

Ion 91.00 (90.70 to 91.70): 1301020.D
MeOH Blank 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

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No peaks detected

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m/e 91, Aromatics ION91.TXT 0201002 179

Peak-by-peak integration m/e 91 A

→ Ion 91.00 (90.70 to 91.70): 0201002.D
GAS2 STOCK (fresh) DF40 MeOH

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
[redacted] 1	16.629	BV	0.065	49269338	16.508	16.847
2	16.863	VV	0.080	152508	16.847	16.985
[redacted] 3	22.673	BV	0.066	14404739	22.541	23.001
4	23.200	BV	0.085	34737296	23.028	23.470
5	24.729	PV	0.068	14749987	24.590	24.938
[redacted] 6	28.665	PV	0.063	4939370	28.507	28.876
7	29.130	VV	0.069	1271192	29.035	29.200
8	29.249	VV	0.069	559306	29.200	29.381
9	29.587	VV	0.062	514360	29.381	29.752
10	30.290	BV	0.061	407288	30.154	30.375
11	31.179	PV	0.065	1414523	31.026	31.339
12	32.095	PV	0.063	249080	31.997	32.174
13	32.963	VV	0.071	265783	32.901	33.057
14	33.781	BV	0.080	197395	33.607	33.874
15	34.660	VV	0.071	235531	34.588	34.732
16	34.968	VV	0.103	1058528	34.783	35.152
17	36.196	VV	0.066	252997	36.084	36.259
18	36.318	VV	0.064	242611	36.259	36.446
19	36.673	PV	0.060	354673	36.581	36.761
20	38.421	PV	0.069	251652	38.264	38.539
21	38.632	VV	0.070	330725	38.539	38.805
22	39.630	PV	0.073	169138	39.502	39.692
23	40.159	PV	0.066	125768	40.058	4

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0.242

Ion 91.00 (90.70 to 91.70): 0301003.D
GAS2-2, 6/7/97 DF40 MeOH Bi-Ph 32/10

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	16.623	BV	0.063	59234671	16.490	16.847
2	16.865	VV	0.041	70475	16.847	16.930
3	22.664	PV	0.066	17510388	22.503	22.826
4	23.191	BV	0.083	41868425	23.065	23.524
5	24.719	PV	0.069	17814287	24.562	25.074
6	28.654	PV	0.068	5962754	28.546	28.814
7	29.124	VV	0.067	1606736	28.886	29.192
8	29.242	VV	0.071	654795	29.192	29.412
9	29.574	VV	0.061	531650	29.450	29.710
10	30.285	BV	0.066	479210	30.081	30.401
11	31.170	PV	0.070	1715929	31.056	31.348
12	32.088	PV	0.062	300525	31.884	32.186
13	32.950	VV	0.074	330083	32.875	33.040
14	33.769	BV	0.058	223829	33.607	33.884
15	34.516	PV	0.054	141144	34.423	34.571
16	34.649	VV	0.065	288392	34.571	34.798
17	34.951	PV	0.071	823175	34.798	35.006
18	35.024	VV	0.063	429156	35.006	35.237
19	36.185	PV	0.073	339729	35.906	36.249
20	36.306	VV	0.065	264258	36.249	36.420
21	36.658	VV	0.069	426117	36.548	36.748
22	38.402	PV	0.080	316024	38.262	38.402

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8.548						
23	38.619	VV	0.061	364070	38.548	3
8.740						
24	39.608	PV	0.076	211573	39.483	3
9.693						
25	40.147	PV	0.064	162235	40.061	4
0.215						

Ion 91.00 (90.70 to 91.70): 0401004.D
GAS2-3, 6/8/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End
Time						
1	16.618	BV	0.064	52075838	16.499	1
6.830						
2	16.857	VV	0.040	66979	16.830	1
6.899						
3	22.660	BV	0.067	15353270	22.532	2
2.848						
4	23.185	VV	0.088	37023215	23.055	2
3.455						
5	24.717	PV	0.069	15230120	24.561	2
4.923						
6	28.649	PV	0.071	5217707	28.479	2
8.862						
7	29.119	VV	0.059	1391215	29.005	2
9.189						
8	29.237	VV	0.060	556509	29.189	2
9.365						
9	29.569	VV	0.064	502409	29.475	2
9.665						
10	30.281	PV	0.076	478550	30.188	3
0.411						
11	31.165	PV	0.072	1530755	31.048	3
1.284						
12	32.067	VV	0.066	298615	31.880	3
2.192						
13	32.939	VV	0.079	350029	32.883	3
3.138						
14	33.769	PV	0.078	262272	33.552	3
3.863						
15	34.643	VV	0.075	262360	34.560	3
4.749						
16	34.957	VV	0.067	675382	34.749	3
4.987						
17	35.008	VV	0.062	470524	34.987	3
5.156						
18	36.184	BV	0.074	232950	36.087	3
6.238						
19	36.300	VV	0.056	216378	36.238	3

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6.464						
20	36.650	PV	0.062	352825	36.567	3
6.743						
21	38.403	VV	0.070	257864	38.308	3
8.534						
22	38.618	VV	0.068	370223	38.534	3
8.744						
23	39.610	PV	0.078	177926	39.486	3
9.672						
24	40.148	PV	0.070	156619	40.031	4
0.215						

Ion 91.00 (90.70 to 91.70): 0601006.D
GAS2-5, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	16.620	BV	0.065	60942113	16.453	1
6.894						
2	16.913	VV	0.031	29227	16.894	1
6.952						
3	22.660	BV	0.065	18087370	22.532	2
2.793						
4	23.189	PV	0.085	42565476	22.994	2
3.417						
5	24.717	PV	0.068	18011521	24.580	2
4.839						
6	28.653	BV	0.068	6176199	28.529	2
8.825						
7	29.124	VV	0.071	1647119	29.024	2
9.191						
8	29.246	VB	0.063	643400	29.191	2
9.429						
9	29.567	BV	0.072	630577	29.447	2
9.833						
10	30.275	BV	0.069	547030	30.200	3
0.436						
11	31.168	PV	0.065	1783276	31.026	3
1.323						
12	32.076	PV	0.071	320155	31.883	3
2.186						
13	32.954	PV	0.068	404691	32.697	3
3.031						
14	33.756	VV	0.069	266328	33.686	3
3.874						
15	34.502	VV	0.072	150436	34.409	3
4.568						
16	34.646	VV	0.060	279473	34.568	3
4.740						
17	34.951	PV	0.103	1309494	34.740	3

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5.187						
18	36.175	BV	0.062	286783	36.022	3
6.237						
19	36.299	VV	0.062	253528	36.237	3
6.453						
20	36.657	PV	0.067	447333	36.558	3
6.756						
21	38.409	BV	0.063	237712	38.282	3
8.514						
22	38.620	VV	0.078	352382	38.514	3
8.707						
23	39.619	VV	0.077	237968	39.513	3
9.698						
24	40.154	PV	0.073	188309	40.031	4
0.213						

Ion 91.00 (90.70 to 91.70): 0701014.D
GAS2-6, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End
Time						
1	16.604	BV	0.064	52472413	16.490	1
6.765						
2	16.782	VV	0.049	140915	16.765	1
6.878						
3	22.643	VV	0.066	15470093	22.486	2
2.850						
4	23.170	VV	0.087	37393226	23.030	2
3.453						
5	24.700	PV	0.068	15503193	24.579	2
4.868						
6	28.632	BV	0.068	5010670	28.511	2
8.812						
7	29.105	PV	0.067	1382705	28.952	2
9.173						
8	29.227	VV	0.064	567102	29.173	2
9.401						
9	29.556	VV	0.067	512631	29.465	2
9.714						
10	30.262	PV	0.071	486409	30.123	3
0.402						
11	31.151	PV	0.068	1555474	31.009	3
1.279						
12	32.054	PV	0.069	264839	31.920	3
2.173						
13	32.931	VV	0.070	330829	32.878	3
3.104						
14	33.755	VV	0.060	231660	33.651	3
3.867						
15	34.491	VV	0.057	137575	34.413	3

4.547						
16	34.621	VV	0.064	272858	34.547	3
4.779						
17	34.923	PV	0.074	688281	34.779	3
4.978						
18	34.992	VV	0.070	412020	34.978	3
5.150						
19	36.162	VV	0.061	241611	36.095	3
6.228						
20	36.281	VV	0.066	239839	36.228	3
6.396						
21	36.641	VV	0.072	387138	36.555	3
6.729						
22	38.397	PV	0.072	261677	38.272	3
8.515						
23	38.605	VV	0.067	312545	38.515	3
8.734						
24	39.603	BV	0.064	138549	39.466	3
9.663						
25	40.146	PV	0.058	155689	39.964	4
0.203						

Ion 91.00 (90.70 to 91.70): 0801015.D
GAS2-7, DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	16.609	BV	0.064	58118281	16.490	1
6.821						
2	16.835	VV	0.048	95391	16.821	1
6.914						
3	22.648	PV	0.069	17371174	22.483	2
2.854						
4	23.176	VV	0.082	41782317	23.024	2
3.439						
5	24.705	PV	0.067	17544878	24.577	2
4.957						
6	28.641	PV	0.067	5914011	28.528	2
8.762						
7	29.109	VV	0.069	1599077	28.970	2
9.176						
8	29.229	VV	0.068	679220	29.176	2
9.330						
9	29.560	VV	0.065	613885	29.473	2
9.693						
10	30.269	VV	0.072	544577	30.187	3
0.406						
11	31.154	PV	0.068	1699701	30.998	3
1.271						
12	32.074	BV	0.062	297274	31.963	3

2.176						
13	32.941	VV	0.071	484433	32.860	3
3.122						
14	33.762	PV	0.062	233962	33.656	3
3.854						
15	34.620	VV	0.059	265551	34.566	3
4.727						
16	34.951	PV	0.081	840350	34.797	3
4.996						
17	35.016	VV	0.059	399165	34.996	3
5.241						
18	36.157	BV	0.067	271607	36.059	3
6.239						
19	36.294	VV	0.067	236387	36.239	3
6.419						
20	36.647	BV	0.059	459027	36.564	3
6.744						
21	38.391	BV	0.071	272850	38.254	3
8.512						
22	38.606	VV	0.070	395652	38.544	3
8.777						
23	39.608	PV	0.072	165872	39.433	3
9.680						
24	40.140	BV	0.061	184380	40.054	4
0.211						

Ion 91.00 (90.70 to 91.70): 0901009.D
GAS2-8, 6/9/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	16.613	BV	0.065	51233731	16.490	1
6.796						
2	16.830	VV	0.041	69555	16.796	1
6.861						
3	22.653	PV	0.068	15021554	22.448	2
2.783						
4	23.183	PV	0.083	36532168	23.063	2
3.406						
5	24.711	BV	0.067	15261437	24.552	2
4.959						
6	28.646	PV	0.069	5069573	28.482	2
8.820						
7	29.113	VV	0.073	1310567	29.015	2
9.182						
8	29.235	VV	0.062	578581	29.182	2
9.376						
9	29.566	PV	0.058	455719	29.490	2
9.652						
10	30.281	VV	0.071	477656	30.159	3

0.449						
11	31.161	PV	0.061	1468401	30.898	3
1.348						
12	32.072	BV	0.068	250528	31.991	3
2.192						
13	32.948	PV	0.085	358250	32.735	3
3.036						
14	33.760	PV	0.076	245418	33.662	3
3.900						
15	34.509	PV	0.061	140931	34.441	3
4.569						
16	34.633	VV	0.071	256692	34.569	3
4.766						
17	34.959	VV	0.075	659248	34.766	3
4.994						
18	35.027	VV	0.054	397499	34.994	3
5.213						
19	36.180	BV	0.067	230284	36.087	3
6.239						
20	36.295	VV	0.061	227555	36.239	3
6.417						
21	36.649	VV	0.056	342675	36.574	3
6.739						
22	38.402	PV	0.076	257923	38.281	3
8.505						
23	38.623	VV	0.070	347253	38.505	3
8.760						
24	39.617	PV	0.068	203375	39.469	3
9.689						
25	40.147	PV	0.084	239926	40.010	4
0.224						

Ion 91.00 (90.70 to 91.70): 1001010.D
GAS2-9, 6/10/97 DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End
Time						
1	16.613	BV	0.064	54645451	16.499	1
6.878						
2	22.654	PV	0.065	16380015	22.496	2
2.898						
3	23.181	VV	0.081	38577303	23.062	2
3.468						
4	24.711	PV	0.071	16372525	24.556	2
5.028						
5	28.642	PV	0.069	5416619	28.534	2
8.852						
6	29.115	VV	0.072	1402323	29.008	2
9.186						
7	29.231	VV	0.069	584391	29.186	2

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Peak#	Ret Time	Type	Width	Area	Start Time	End Time
8	29.569	VV	0.072	557426	29.416	29.709
9	30.276	VV	0.078	527638	30.187	30.509
10	31.165	PV	0.066	1566758	30.991	31.278
11	32.075	BV	0.055	265700	31.991	32.186
12	32.947	VV	0.085	401737	32.868	33.176
13	33.771	PV	0.068	247497	33.644	33.910
14	34.638	VV	0.069	267333	34.573	34.780
15	34.946	VV	0.114	1146692	34.780	35.128
16	36.178	VV	0.071	239251	36.101	36.239
17	36.297	VV	0.060	226751	36.239	36.391
18	36.652	PV	0.071	398635	36.551	36.748
19	38.405	BV	0.057	226279	38.337	38.512
20	38.621	VB	0.075	309949	38.512	38.748
21	39.597	PV	0.080	192815	39.475	39.683
22	40.154	PV	0.074	190200	40.036	40.208

Ion 91.00 (90.70 to 91.70): 1101011.D
GAS2-10, DF40 MeOH Bi-Ph 19/28 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time
1	16.614	BV	0.065	60106727	16.490	16.782
2	16.798	VV	0.042	83380	16.782	16.852
3	22.653	PV	0.067	17968016	22.478	22.837
4	23.180	VV	0.084	43394156	22.962	23.461
5	24.712	PV	0.068	17953223	24.575	24.944
6	28.641	PV	0.069	5996585	28.528	28.894
7	29.110	VV	0.060	1611934	28.970	29.209

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9.182						
8	29.232	VV	0.064	646998	29.182	2
9.379						
9	29.570	PV	0.066	612804	29.453	2
9.705						
10	30.280	PV	0.075	567641	30.146	3
0.386						
11	31.160	PV	0.067	1720327	30.916	3
1.269						
12	32.074	BV	0.063	309216	31.982	3
2.189						
13	32.942	VV	0.074	416325	32.869	3
3.093						
14	33.762	PV	0.064	249773	33.654	3
3.856						
15	34.505	BV	0.056	136843	34.434	3
4.566						
16	34.637	VV	0.061	284671	34.566	3
4.729						
17	34.951	PV	0.073	814627	34.729	3
4.991						
18	35.011	VV	0.061	439229	34.991	3
5.126						
19	36.182	PV	0.077	300872	36.069	3
6.239						
20	36.299	VV	0.060	257423	36.239	3
6.407						
21	36.649	VV	0.065	431387	36.563	3
6.754						
22	38.408	BV	0.071	261516	38.282	3
8.502						
23	38.613	VV	0.072	382697	38.539	3
8.860						
24	39.614	VV	0.077	223545	39.501	3
9.672						
25	40.140	PV	0.058	176341	40.035	4
0.234						

Ion 91.00 (90.70 to 91.70): 1201012.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

Ion 91.00 (90.70 to 91.70): 1201019.D
GAS2-11, Cell Soln. DF40 MeOH 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End

Time
No peaks detected

Ion 91.00 (90.70 to 91.70): 1301020.D
MeOH Blank 0.5uL

Peak#	Ret Time	Type	Width	Area	Start Time	End Time

No peaks detected

A-85

0601006
LibSrch Apex

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Information from Data File:
File : C:\HPCHEM\1\DATA\RUNGAS\0601006.D
Operator :
Acquired : 13 Jun 97 10:24 pm using AcqMethod SCAN
Sample Name: GAS2-5, DF40 MeOH 0.5uL
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 6

Search Libraries: C:\DATABASE\NBS75K.L Minimum Quality: 0

Unknown Spectrum: Apex
Integration Params: events.e

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
1	5.81	1.98	C:\DATABASE\NBS75K.L			
			Butane, 2-methyl-	62518	000078-78-4	68
			Butane, 2-methyl-	62517	000078-78-4	59
			Butane, 2-methyl-	281	000078-78-4	53
2	5.94	7.07	C:\DATABASE\NBS75K.L			
			Acetone	62324	000067-64-1	80
			Acetone	62327	000067-64-1	78
			Acetone	62325	000067-64-1	72
3	6.19	1.58	C:\DATABASE\NBS75K.L			
			Pentane	62515	000109-66-0	64
			Pentane	62516	000109-66-0	64
			Pentane	280	000109-66-0	53
4	6.33	0.34	C:\DATABASE\NBS75K.L			
			Cyclopropane, 1,2-dimethyl-, trans	62459	002402-06-4	58
			2-Pentene, (Z)-	62456	000627-20-3	49
			2-Pentene, (Z)-	224	000627-20-3	47
5	6.48	0.18	C:\DATABASE\NBS75K.L			
			Cyclopropane, 1,2-dimethyl-, trans	62459	002402-06-4	43
			Cyclopropane, 1,2-dimethyl-, cis-	62467	000930-18-7	38
			Oxetane, 3-(1-methylethyl)-	1538	010317-17-6	35
6	6.58	0.53	C:\DATABASE\NBS75K.L			
			2-Butene, 2-methyl-	62462	000513-35-9	52
			2-Pentene	231	000109-68-2	52
			1-Butene, 2-methyl-	62457	000563-46-2	52
7	6.89	0.18	C:\DATABASE\NBS75K.L			
			Cyanic acid, ethyl ester	237	000627-48-5	9
			2-Propenamide	241	000079-06-1	5
			Ethylene glycol diglycidyl ether	16109	002224-15-9	4
8	7.37	0.19	C:\DATABASE\NBS75K.L			
			Cyclopentene	185	000142-29-0	35
			Cyclopropane, methylmethylene-	183	018631-84-0	27
			Cyclopentene	62411	000142-29-0	16
9	7.61	0.78	C:\DATABASE\NBS75K.L			
			Butane, 2,3-dimethyl-	735	000079-29-8	72
			Butane, 2,3-dimethyl-	62871	000079-29-8	56
			Butane, 2,3-dimethyl-	62870	000079-29-8	53

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
10	7.70	2.00	C:\DATABASE\NBS75K.L			
			Pentane, 2-methyl-	62863	000107-83-5	91
			Pentane, 2-methyl-	62865	000107-83-5	91
			Pentane, 2-methyl-	62866	000107-83-5	76
11	8.12	1.33	C:\DATABASE\NBS75K.L			
			Pentane, 3-methyl-	62867	000096-14-0	78
			Pentane, 3-methyl-	62868	000096-14-0	72
			Pentane, 3-methyl-	734	000096-14-0	56
12	8.23	0.09	C:\DATABASE\NBS75K.L			
			Hydrazine, 2-propenyl-	255	007422-78-8	45
			2-Butanone	62493	000078-93-3	38
			2-Butanone	62491	000078-93-3	38
13	8.30	0.23	C:\DATABASE\NBS75K.L			
			Cyclohexane	62779	000110-82-7	52
			Oxirane, (1-methylbutyl)-	3012	053229-39-3	50
			Cyclohexane	62778	000110-82-7	49
14	8.65	1.74	C:\DATABASE\NBS75K.L			
			Hexane	62873	000110-54-3	91
			Hexane	62874	000110-54-3	91
			Hexane	62872	000110-54-3	90
15	8.75	0.11	C:\DATABASE\NBS75K.L			
			Cyclopentanone	62723	000120-92-3	64
			2-Butenal, 2-methyl-	62741	001115-11-3	32
			3-Hexene, (E)-	62750	013269-52-8	30
16	8.85	0.22	C:\DATABASE\NBS75K.L			
			2-Hexene	62759	000592-43-8	53
			Cyclopentanone	62723	000120-92-3	50
			2-Hexene, (E)-	62751	004050-45-7	47
17	8.93	0.25	C:\DATABASE\NBS75K.L			
			2-Pentene, 2-methyl-	62764	000625-27-4	76
			2-Pentene, 4-methyl-, (E)-	603	000674-76-0	64
			2-Pentene, 4-methyl-, (Z)-	601	000691-38-3	64
18	9.06	0.22	C:\DATABASE\NBS75K.L			
			2-Butene, 2,3-dimethyl-	62762	000563-79-1	38
			2-Pentene, 2-methyl-	595	000625-27-4	38
			2-Pentene, 3-methyl-, (Z)-	608	000922-62-3	38
19	9.19	0.16	C:\DATABASE\NBS75K.L			
			2H-Pyran, 3,4-dihydro-	62718	000110-87-2	46
			3-Hexene, (Z)-	62780	007642-09-3	46
			Cyclopentanone	62723	000120-92-3	43
20	9.42	0.25	C:\DATABASE\NBS75K.L			
			2-Pentene, 3-methyl-, (Z)-	62781	000922-62-3	64
			2-Pentene, 3-methyl-, (E)-	62773	000616-12-6	59
			2-Pentene, 2-methyl-	62764	000625-27-4	58

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
21	9.53	0.11	C:\DATABASE\NBS75K.L			
			Butane, 2,2,3-trimethyl-	1599	000464-06-2	38
			Pentane, 2,2,3,4-tetramethyl-	5164	001186-53-4	12
			Heptane, 2,2,4-trimethyl-	8105	014720-74-2	10
22	9.74	2.12	C:\DATABASE\NBS75K.L			
			Cyclopentane, methyl-	594	000096-37-7	72
			Cyclopentane, methyl-	62763	000096-37-7	64
			Hexane, 3,4-dimethyl-	64211	000583-48-2	59
23	10.69	0.32	C:\DATABASE\NBS75K.L			
			Cyclopentene, 1-methyl-	62682	000693-89-0	62
			Cyclopropane, (1-methylethenyl)-	490	004663-22-3	58
			Cyclohexene	62694	000110-83-8	53
24	10.93	2.79	C:\DATABASE\NBS75K.L			
			Benzene	62626	000071-43-2	91
			Benzene	62628	000071-43-2	83
			Benzene	62627	000071-43-2	83
25	11.18	0.88	C:\DATABASE\NBS75K.L			
			Cyclohexane	62777	000110-82-7	90
			Cyclohexane	62776	000110-82-7	90
			Cyclohexane	606	000110-82-7	87
26	11.39	1.25	C:\DATABASE\NBS75K.L			
			Hexane, 2-methyl-	1598	000591-76-4	90
			Hexane, 2-methyl-	63435	000591-76-4	90
			Pentane, 3-ethyl-2,4-dimethyl-	5138	001068-87-7	53
27	11.51	1.77	C:\DATABASE\NBS75K.L			
			Pentane, 2,3-dimethyl-	1597	000565-59-3	91
			Pentane, 2,3-dimethyl-	63429	000565-59-3	91
			Pentane, 2,3-dimethyl-	63430	000565-59-3	91
28	11.82	1.46	C:\DATABASE\NBS75K.L			
			Hexane, 3-methyl-	63423	000589-34-4	91
			Hexane, 3-methyl-	1593	000589-34-4	91
			Hexane, 3-methyl-	63421	000589-34-4	87
29	12.23	0.42	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-	1316	002453-00-1	72
			Cyclopentane, 1,3-dimethyl-, cis-	63267	002532-58-3	64
			Cyclopentane, 1,3-dimethyl-, trans	1329	001759-58-6	58
30	12.38	0.53	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,3-dimethyl-, cis-	63267	002532-58-3	93
			Cyclopentane, 1,3-dimethyl-, trans	1329	001759-58-6	90
			Cyclopentane, 1,3-dimethyl-, cis-	1360	002532-58-3	86
31	12.49	2.57	C:\DATABASE\NBS75K.L			
			Pentane, 2,2,4-trimethyl-	64220	000540-84-1	72
			Pentane, 2,2,4-trimethyl-	64221	000540-84-1	64
			Hexane, 2,2,5-trimethyl-	65126	003522-94-9	59

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
32	13.04	1.22	C:\DATABASE\NBS75K.L			
			Heptane	63438	000142-82-5	91
			3-Hexanone	63356	000589-38-8	43
			Butane, 2,2-dimethyl-	62862	000075-83-2	43
33	13.21	0.40	C:\DATABASE\NBS75K.L			
			2-Hexene, 2-methyl-	63229	002738-19-4	55
			2-Hexene, 2-methyl-	1321	002738-19-4	49
			2-Hexene, 3-methyl-, (Z)-	1322	010574-36-4	45
34	13.62	0.13	C:\DATABASE\NBS75K.L			
			2-Hexene, 2-methyl-	63229	002738-19-4	47
			2-Hexene, 2-methyl-	1321	002738-19-4	47
			2-Hexene, 4-methyl-, (E)-	1341	003683-22-5	43
35	13.76	0.11	C:\DATABASE\NBS75K.L			
			Furan, 2-ethyl-	63118	003208-16-0	64
			1,4-Hexadiene, 4-methyl-	1151	001116-90-1	58
			2,4-Hexadiene, 3-methyl-	1130	028823-42-9	53
36	14.34	1.02	C:\DATABASE\NBS75K.L			
			Cyclohexane, methyl-	1326	000108-87-2	91
			Cyclohexane, methyl-	63234	000108-87-2	91
			1H-Pyrazole, 4,5-dihydro-4,5-dimet	1232	028019-94-5	64
37	14.80	0.36	C:\DATABASE\NBS75K.L			
			Hexane, 2,5-dimethyl-	64204	000592-13-2	81
			Hexane, 2,5-dimethyl-	64206	000592-13-2	81
			Hexane, 2,5-dimethyl-	64205	000592-13-2	64
38	14.94	0.65	C:\DATABASE\NBS75K.L			
			Hexane, 2,4-dimethyl-	3089	000589-43-5	74
			Hexane, 2,4-dimethyl-	64212	000589-43-5	64
			Pentane, 2,2,3,4-tetramethyl-	5164	001186-53-4	53
39	15.38	0.18	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,2,4-trimethyl-	2680	002815-58-9	43
			Octane, 3-methyl-6-methylene-	7581	074630-07-2	43
			Tridecane, 3-methylene-	21984	019780-34-8	38
40	15.82	0.12	C:\DATABASE\NBS75K.L			
			cis-1-Butyl-2-methylcyclopropane	2683	038851-69-3	33
			Cyclopentane, 1,2,3-trimethyl-, (1	2718	015890-40-1	30
			1-Octene	63996	000111-66-0	27
41	15.93	1.07	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	78
			Pentane, 2,3,4-trimethyl-	64228	000565-75-3	59
			Pentane, 3,3-dimethyl-	1596	000562-49-2	47
42	16.11	0.17	C:\DATABASE\NBS75K.L			
			Cyclopentene, 4,4-dimethyl-	1107	019037-72-0	72
			Cyclohexene, 3-methyl-	1126	000591-48-0	64
			Cyclopentene, 1,5-dimethyl-	1136	016491-15-9	64

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
43	16.23	1.32	C:\DATABASE\NBS75K.L			
			Pentane, 2,3,3-trimethyl-	3088	000560-21-4	83
			Decane, 3,3,4-trimethyl-	19045	049622-18-6	59
			Pentane, 2,3,4-trimethyl-	64229	000565-75-3	53
44	16.63	12.55	C:\DATABASE\NBS75K.L			
			Toluene	63030	000108-88-3	91
			Toluene	63031	000108-88-3	87
			Toluene	63028	000108-88-3	81
45	16.86	0.47	C:\DATABASE\NBS75K.L			
			Heptane, 2-methyl-	64218	000592-27-8	91
			Heptane, 2-methyl-	64219	000592-27-8	91
			Hexane, 2,5-dimethyl-	64206	000592-13-2	76
46	16.96	0.23	C:\DATABASE\NBS75K.L			
			Heptane, 4-methyl-	3096	000589-53-7	87
			Decane, 3,3,4-trimethyl-	19045	049622-18-6	64
			Propanoic acid, 2-methyl-, 2-methy	67431	002445-69-4	59
47	17.33	0.58	C:\DATABASE\NBS75K.L			
			Heptane, 3-methyl-	3099	000589-81-1	87
			Heptane, 3-methyl-	64227	000589-81-1	78
			Hexane, 1-(hexyloxy)-2-methyl-	23019	074421-17-3	59
48	17.42	0.19	C:\DATABASE\NBS75K.L			
			Cyclopentane, 1,2,4-trimethyl-	2680	002815-58-9	30
			Piperidine	62788	000110-89-4	27
			Hexane, 3-ethyl-	3094	000619-99-8	27
49	17.66	0.17	C:\DATABASE\NBS75K.L			
			Cyclohexane, 1,2-dimethyl-, cis-	63988	002207-01-4	64
			Cyclohexane, 1,4-dimethyl-	64013	000589-90-2	53
			Cyclohexane, 1,2-dimethyl-, trans-	2673	006876-23-9	52
50	17.96	0.33	C:\DATABASE\NBS75K.L			
			Hexane, 2,2,5-trimethyl-	65129	003522-94-9	59
			Hexane, 2,2,5,5-tetramethyl-	66226	001071-81-4	59
			Hexane, 2,2,4-trimethyl-	5131	016747-26-5	50
51	18.89	0.14	C:\DATABASE\NBS75K.L			
			4-Octene, (E)-	64041	014850-23-8	76
			4-Octene, (E)-	64040	014850-23-8	76
			2-Octene, (Z)-	2713	007642-04-8	70
52	18.98	0.51	C:\DATABASE\NBS75K.L			
			Octane	64209	000111-65-9	91
			Octane	3084	000111-65-9	83
			Heptane, 2,4-dimethyl-	5145	002213-23-2	56
53	19.57	0.18	C:\DATABASE\NBS75K.L			
			1,3-Dimethyl-1-cyclohexene	2371	002808-76-6	80
			2-Ethyl-5-methylfuran	2287	000000-00-0	64
			Cyclopentene, 1,2,3-trimethyl-	2340	000473-91-6	59

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
54	21.31	0.18	C:\DATABASE\NBS75K.L			
			Heptane, 3,5-dimethyl-	65119	000926-82-9	53
			Heptane, 3-ethyl-2-methyl-	8080	014676-29-0	47
			Heptane, 2,3,6-trimethyl-	8096	004032-93-3	47
55	22.66	3.48	C:\DATABASE\NBS75K.L			
			Ethylbenzene	63690	000100-41-4	91
			Ethylbenzene	63691	000100-41-4	91
			Ethylbenzene	2026	000100-41-4	91
56	23.19	10.69	C:\DATABASE\NBS75K.L			
			Benzene, 1,3-dimethyl-	63695	000108-38-3	94
			p-Xylene	63700	000106-42-3	94
			p-Xylene	63699	000106-42-3	94
57	23.63	0.30	C:\DATABASE\NBS75K.L			
			Octane, 3-methyl-	5150	002216-33-3	68
			Octane, 3-methyl-	65130	002216-33-3	64
			Decane, 2,5-dimethyl-	68262	017312-50-4	50
58	24.11	0.24	C:\DATABASE\NBS75K.L			
			Octane, 2,2-dimethyl-	8097	015869-87-1	59
			Pentane, 2,2,3,4-tetramethyl-	65146	001186-53-4	53
			2,2,6,6-Tetramethylheptane	11610	040117-45-1	53
59	24.56	0.25	C:\DATABASE\NBS75K.L			
			Octane, 2,2-dimethyl-	8097	015869-87-1	53
			Heptane, 2,2-dimethyl-	65135	001071-26-7	47
			Butane, 2,2,3-trimethyl-	63436	000464-06-2	47
60	24.71	4.27	C:\DATABASE\NBS75K.L			
			~~Benzene, 1,3-dimethyl-~~	63696	000108-38-3	95
			~~Benzene, 1,3-dimethyl-~~	63695	000108-38-3	94
			~~p-Xylene~~	63702	000106-42-3	94
61	25.41	0.37	C:\DATABASE\NBS75K.L			
			Heptadecane	71191	000629-78-7	72
			Heptane, 2,6-dimethyl-	5156	001072-05-5	64
			Dodecane, 2,6,11-trimethyl-	25998	031295-56-4	64
62	26.53	0.21	C:\DATABASE\NBS75K.L			
			Hexane, 4-ethyl-2-methyl-	5158	003074-75-7	50
			Decane, 2,5,6-trimethyl-	19019	062108-23-0	50
			Octane, 2,5,6-trimethyl-	11607	062016-14-2	47
63	26.78	0.29	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	91
			Benzene, (1-methylethyl)-	64553	000098-82-8	91
			Benzene, (1-methylethyl)-	3763	000098-82-8	91
64	28.65	1.04	C:\DATABASE\NBS75K.L			
			Benzene, propyl-	64583	000103-65-1	91
			Benzene, propyl-	3781	000103-65-1	87
			Benzene, propyl-	64582	000103-65-1	87

meta; para-xylene, unresolved

O-xylene

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
65	29.12	3.31	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64557	000611-14-3	95
			Benzene, 1-ethyl-3-methyl-	64563	000620-14-4	95
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	94
66	29.25	1.48	C:\DATABASE\NBS75K.L			
			Benzene, 1-ethyl-2-methyl-	64559	000611-14-3	95
			Benzene, 1-ethyl-2-methyl-	64558	000611-14-3	91
			Benzene, 1-ethyl-4-methyl-	3770	000622-96-8	91
67	29.45	0.46	C:\DATABASE\NBS75K.L			
			Heptane, 2,2,4,6,6-pentamethyl-	15367	013475-82-6	50
			Hexane, 2,2,5-trimethyl-	5149	003522-94-9	47
			Heptane, 2,2-dimethyl-	65135	001071-26-7	47
68	29.57	1.72	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64571	000108-67-8	94
			Benzene, 1,2,3-trimethyl-	64574	000526-73-8	94
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	94
69	30.27	1.24	C:\DATABASE\NBS75K.L			
			Benzene, 1,3,5-trimethyl-	64570	000108-67-8	91
			Benzene, 1-ethyl-2-methyl-	3765	000611-14-3	91
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	91
70	31.17	5.07	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3-trimethyl-	64574	000526-73-8	94
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	94
			Benzene, 1,3,5-trimethyl-	64570	000108-67-8	93
71	32.95	1.29	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3-trimethyl-	64573	000526-73-8	94
			Benzene, 1,3,5-trimethyl-	64569	000108-67-8	93
			Benzene, 1,2,4-trimethyl-	64577	000095-63-6	91
72	33.77	0.55	C:\DATABASE\NBS75K.L			
			Benzene, ethenylmethyl-	3598	025013-15-4	46
			Benzene, 1-propenyl-	64476	000637-50-3	46
			Benzene, 1-propenyl-, (E)-	3599	000873-66-5	45
73	34.51	0.24	C:\DATABASE\NBS75K.L			
			Benzene, 1,4-diethyl-	65558	000105-05-5	94
			Benzene, 1,3-diethyl-	65564	000141-93-5	94
			Benzene, 1,4-diethyl-	65559	000105-05-5	91
74	34.64	0.69	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-3-propyl-	65527	001074-43-7	91
			Benzene, 1-methyl-3-propyl-	6195	001074-43-7	91
			Benzene, 1-methyl-2-propyl-	65584	001074-17-5	87
75	34.88	0.48	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-2-propyl-	65584	001074-17-5	87
			Benzene, 1-methyl-2-propyl-	6230	001074-17-5	72
			Benzene, 1-methyl-2-propyl-	65583	001074-17-5	72

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
76	35.03	0.81	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-3-(1-methylethyl	65579	000535-77-3	95
			Benzene, 4-ethyl-1,2-dimethyl-	65568	000934-80-5	95
			Benzene, 1-methyl-4-(1-methylethyl	65538	000099-87-6	94
77	35.62	0.28	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-3-propyl-	6195	001074-43-7	87
			Benzene, 1-methyl-4-propyl-	6216	001074-55-1	87
			Benzene, 1-methyl-3-propyl-	65527	001074-43-7	86
78	36.19	0.44	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethyl-1,4-dimethyl-	65570	001758-88-9	94
			Benzene, 1-ethyl-2,3-dimethyl-	6211	000933-98-2	91
			Benzene, 4-ethyl-1,2-dimethyl-	6218	000934-80-5	91
79	36.30	0.42	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-2-(1-methylethyl	6228	000527-84-4	97
			Benzene, 1-methyl-2-(1-methylethyl	65581	000527-84-4	97
			Benzene, 1-methyl-4-(1-methylethyl	65534	000099-87-6	95
80	36.65	0.74	C:\DATABASE\NBS75K.L			
			Benzene, 4-ethyl-1,2-dimethyl-	65568	000934-80-5	95
			Benzene, 2-ethyl-1,4-dimethyl-	6219	001758-88-9	94
			Benzene, 1-ethyl-2,4-dimethyl-	65572	000874-41-9	94
81	36.82	0.19	C:\DATABASE\NBS75K.L			
			2,3-Dihydro-1-methylindene	5901	027133-93-3	87
			Indan, 1-methyl-	65418	000767-58-8	86
			Indan, 1-methyl-	5882	000767-58-8	80
82	37.85	0.16	C:\DATABASE\NBS75K.L			
			Benzene, 4-ethyl-1,2-dimethyl-	6218	000934-80-5	91
			Benzene, 1-ethyl-3,5-dimethyl-	65554	000934-74-7	91
			Benzene, 2-ethyl-1,3-dimethyl-	6200	002870-04-4	91
83	38.40	0.46	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,4,5-tetramethyl-	65576	000095-93-2	97
			Benzene, 1,2,3,5-tetramethyl-	6220	000527-53-7	95
			Benzene, 1,2,3,4-tetramethyl-	6202	000488-23-3	95
84	38.61	0.66	C:\DATABASE\NBS75K.L			
			Benzene, 1,2,3,5-tetramethyl-	6220	000527-53-7	95
			Benzene, 2-ethyl-1,3-dimethyl-	6200	002870-04-4	95
			Benzene, 1,2,3,4-tetramethyl-	65541	000488-23-3	94
85	39.62	0.38	C:\DATABASE\NBS75K.L			
			Benzene, 2-ethenyl-1,4-dimethyl-	5879	002039-89-6	78
			1H-Indene, 2,3-dihydro-4-methyl-	5893	000824-22-6	74
			Benzene, (1-methyl-1-propenyl)-, (	5904	000767-99-7	74
86	40.16	0.49	C:\DATABASE\NBS75K.L			
			2,3-Dihydro-1-methylindene	5901	027133-93-3	93
			1H-Indene, 2,3-dihydro-5-methyl-	5885	000874-35-1	91
			Benzene, (2-methyl-1-propenyl)-	65428	000768-49-0	90

Pk#	RT	Area%	Library/ID	Ref#	CAS#	Qual
87	40.26	0.22	C:\DATABASE\NBS75K.L			
			Benzene, 1-methyl-3-(1-methylethyl	65579	000535-77-3	90
			Benzene, 1,2,4,5-tetramethyl-	65574	000095-93-2	90
			Benzene, 1,2,3,4-tetramethyl-	65540	000488-23-3	90
88	41.01	0.09	C:\DATABASE\NBS75K.L			
			Dodecane, 2,6,11-trimethyl-	25998	031295-56-4	72
			Dodecane, 2,6,10-trimethyl-	25995	003891-98-3	64
			Heptadecane	71193	000629-78-7	59
89	41.77	0.41	C:\DATABASE\NBS75K.L			
			Naphthalene	65148	000091-20-3	94
			Naphthalene	5167	000091-20-3	94
			Naphthalene	65151	000091-20-3	91
90	42.27	0.20	C:\DATABASE\NBS75K.L			
			Benzene, 2,4-dimethyl-1-(1-methyle	9376	004706-89-2	68
			Benzene, 1,3-dimethyl-5-(1-methyle	9379	004706-90-5	64
			Benzene, 1,4-dimethyl-2-(1-methyle	9382	004132-72-3	62
91	42.37	0.15	C:\DATABASE\NBS75K.L			
			1H-Indene, 2,3-dihydro-1,2-dimethy	8947	017057-82-8	90
			Naphthalene, 1,2,3,4-tetrahydro-1-	8942	001559-81-5	60
			1H-Indene, 2,3-dihydro-1,3-dimethy	8968	004175-53-5	60
92	46.39	0.29	C:\DATABASE\NBS75K.L			
			Naphthalene, 2-methyl-	66235	000091-57-6	94
			Naphthalene, 2-methyl-	66236	000091-57-6	94
			Naphthalene, 2-methyl-	66237	000091-57-6	91

File : C:\HPCHEM\1\DATA\RUNGAS\0201002.D
Operator :
Acquired : 13 Jun 97 5:34 pm using AcqMethod SCAN
Instrument : 5971 - In
Sample Name: GAS2 STOCK (fresh) DF40 MeOH
Misc Info : H19 S45 inj250ms270 37Init3/130-5/220 0.5uL
Vial Number: 2