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NAPHTHALENE CONTAMINATION AT THE ONE ALEWIFE CENTER
WETLANDS, CAMBRIDGE, MA

by

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ES 102
Professor Kegley

INTRODUCTION

ONE ALEWIFE CENTER

The site of this study is the property of One Alewife Center, in Cambridge, MA (Fig. A). The building is mostly office space, developed around 1986 by W.R. Grace Co. and Hines Industrial. It is located opposite the MBTA Alewife parking garage. The entire area is extant wetlands, hydrated by the Alewife Brook parkway and surrounding ponds (Fig. B).

Construction of the parking garage has brought heavy traffic into this area of Arlington/Cambridge, causing smog and other air/soil pollution. Contamination of the area did not begin with the extension of the subway and bus lines, however. This particular region has long been a strong center for industry. One of the most powerful employers and environmental polluters of East Arlington/North Cambridge is W.R. Grace, a chemical manufacturer.

W.R. GRACE

W.R. Grace (Cambridge) is located at 62 Whittemore Avenue, adjacent to One Alewife Plaza (Fig. 1,2). This is their Construction Products Division (originally Dewey & Almy Chemical Co.), one of four division headquarters in the Greater Boston area. The other three are: Amicon (Danvers), Cryovac (Woburn), and Polyfibron and Organic Chemicals (Lexington) (Boston Globe, 12/23/90). New building faces on Whittemore Avenue and glossy signs by the roadside do not disguise the face of the old Dewey and Almy Co. in the back (Fig. 3). Right behind the W.R. Grace property is the old Cambridge city dump, which is enclosed by a fence and partially bulldozed. There is some macrolitter visible, but most has been covered with a layer of soil. Residents in the area strongly suspect that Grace used to dump its chemical byproducts over the fence right into the dump, but there is no official correlation.

Such dumping would not seem out of keeping with Grace's present disposal strategies. Elsie Fiore, an Arlington activist, discovered that when this small Cambridge dump closed, Grace began illicitly transporting sludge out to the Arlington town dump

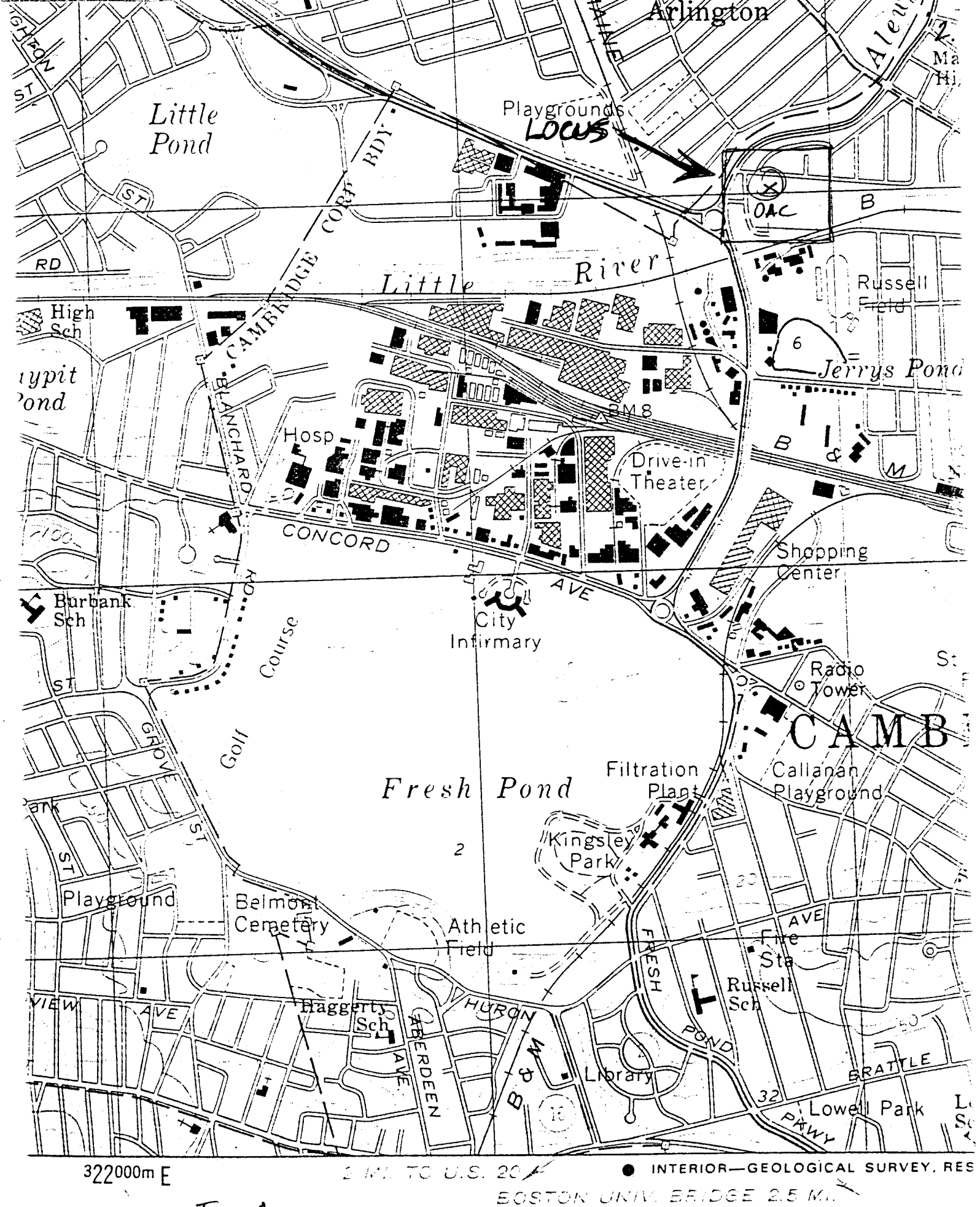


Fig. A

One Alewife Center, Cambridge MA

ROAD CLASSIFICAT

Primary highway.

Light-du

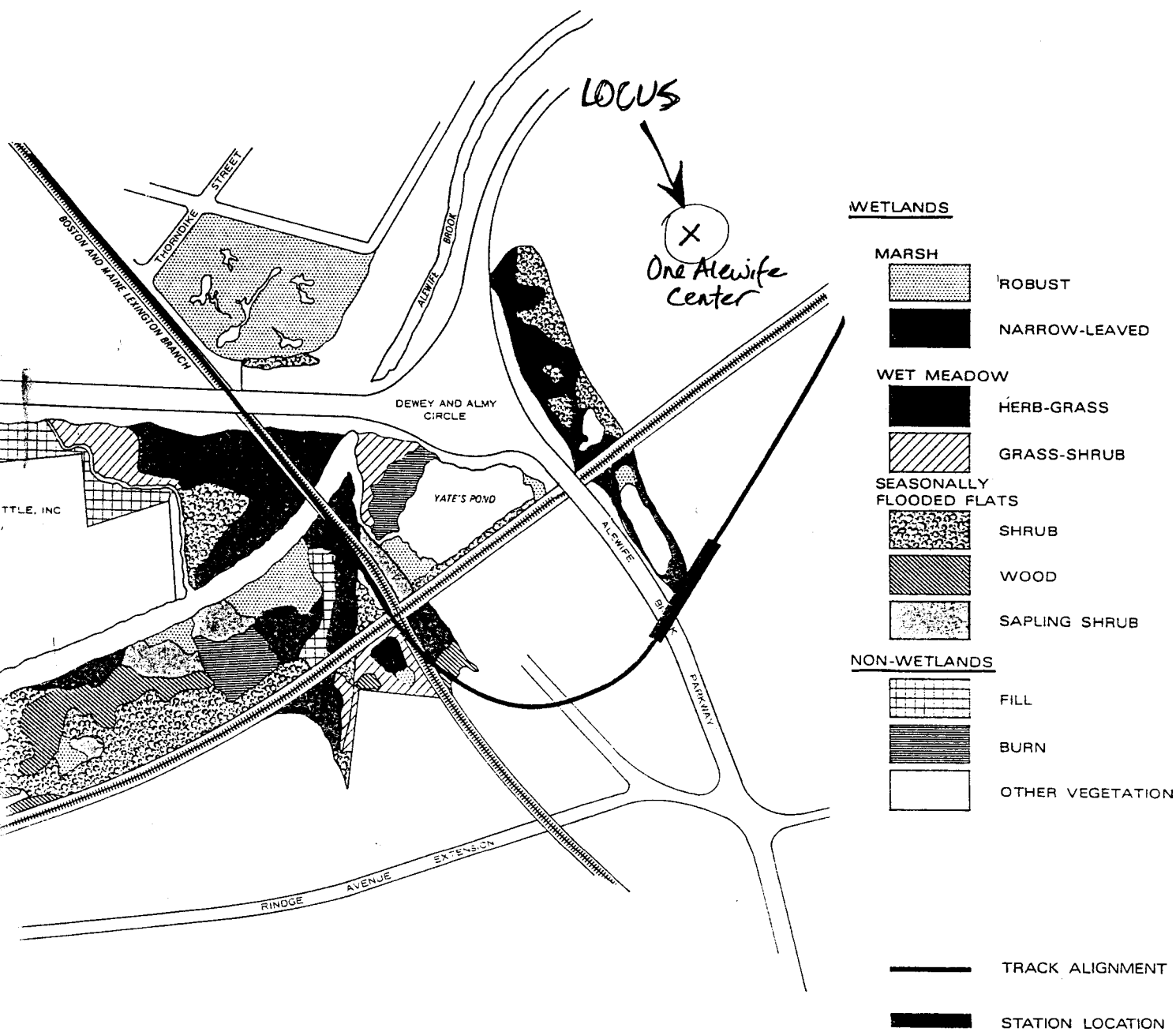


Fig. B
Wetland Veg. Map.

ALEWIFE
WETLAND VEGETATIONAL
CATEGORIES

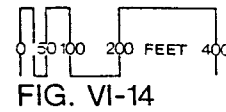


FIG. VI-14



Fig. 1
Study site.

4.

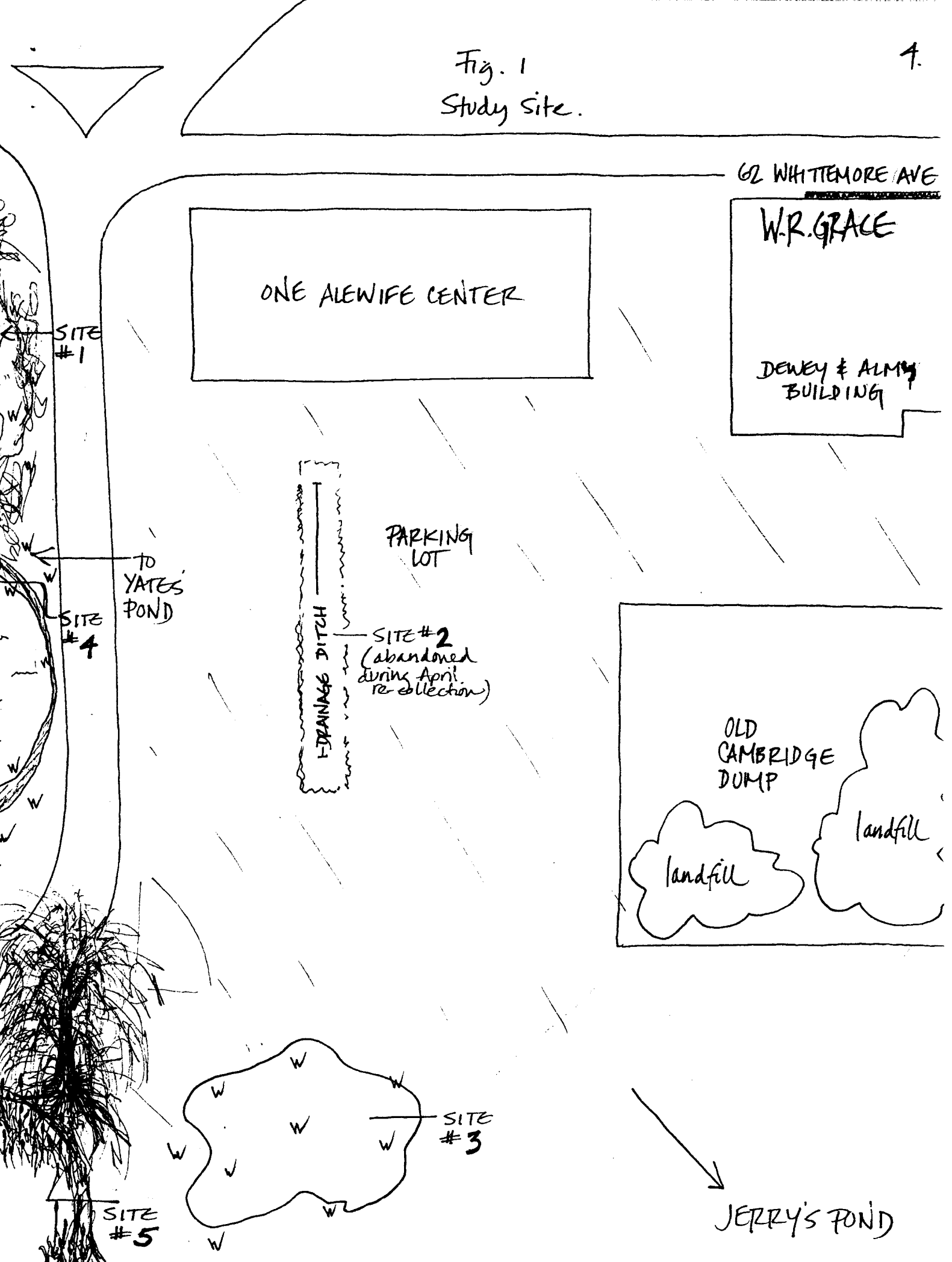


Figure 2.



Fig 2.1 One Alewife Center.
View from the parking lot - wetlands to the left.

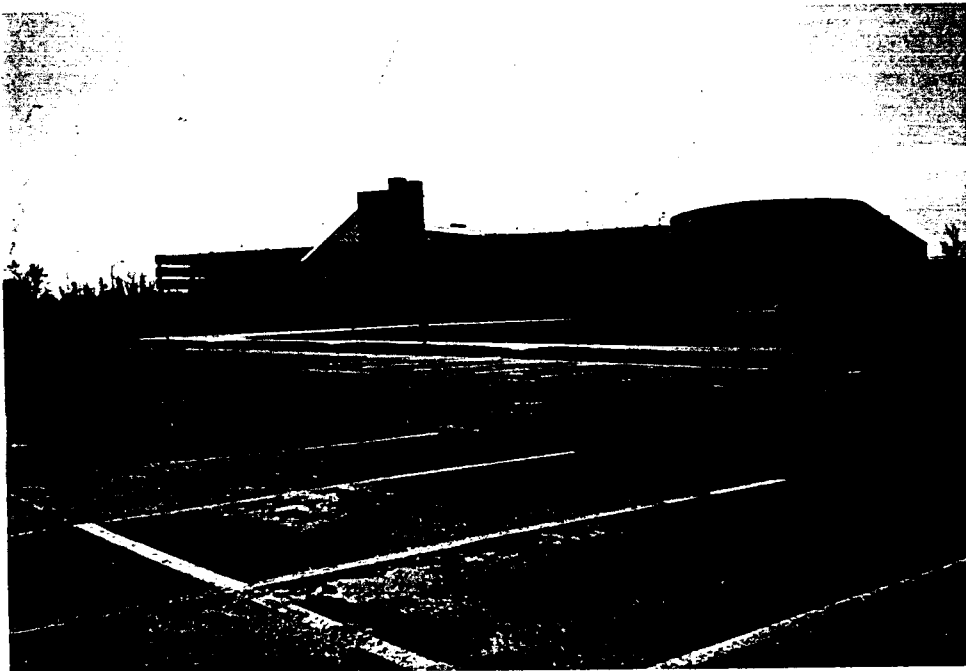


Fig 2.2 MBTA Alewife Parking Garage
Some wetlands on either side of highway.

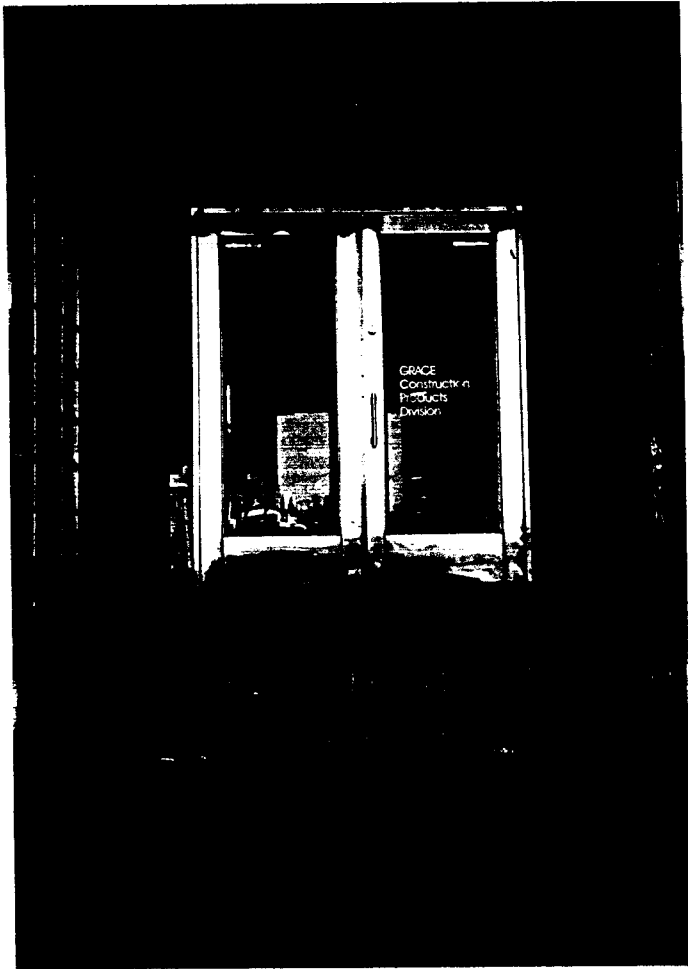


Fig 3.1

The shiny facade
of 62 Whittemore Ave.

Fig 3.2

The mask removed :
old Dewey & Albany
building in back.



↑
One Allwife Plaza

↑
old
Cambridge dm

in the dead of night (pers. comm. with Fiore, 3/30/91). Grace's reputation in the Greater Boston area as an industrial menace is increasing as more and more toxic waste storage and disposal violations come to light.

In 1986, Grace paid \$8 million dollars in an out-of-court settlement to eight Woburn families for contaminating two of the town's public drinking wells. This water has been thought to be the cause of a neighborhood leukemia rash that has killed five children and one adult (Boston Globe, 6/1/88).

In December 1978, chemicals discovered in the Acton public drinking water caused the immediate closing of two town wells. Three others were subsequently found to be contaminated as well. A Grace battery-separator plant was found at fault, and the EPA labeled the property a Superfund toxic waste site. The plant continued operations. It has made plastic insulating sheets to separate the positive and negative plates of car and industrial batteries for thirty-five years (Boston Globe, 12/23/90).

Spills are common. In November 1990, 9,000 gallons of hexane were spilled in a containment area at the Acton plant. Hexane is a highly volatile chemical. Doug Halley, Acton's director of the Board of Health, has commented that most of that spill "was lost in the air," (Globe, 12/23/90).

Accidents may be common, but reporting of such incidents is rare. In 1988, Grace was found guilty of lying to the EPA over use of hazardous chemicals. The EPA monitors the use of toxics through regular company reports. In February 1982, a general manager in Woburn reported that only one 5-gallon drum of acetone was purchased and used by Cryovac over a 22-year period. In the furor over the leukemia breakout, company records were examined during a thorough investigation of the site. These records showed that in 1973-1976 alone, W.R. Grace had bought and used 65 gallons of acetone (Boston Globe, 6/1/88).

Such stories have solidified Grace's environmental reputation. I decided to investigate One Alewife Plaza when I heard a rumor that workers at the building had become sick from fumes and contaminated water. Although I heard this from several

underground sources, I was not able to verify the fact. However, I was able to verify that concern over this possibility was voiced when plans for the building were proposed.

Before developing, Grace conducted an environmental assessment study of the site with an independent firm. Dr. Raymond Herbison, a Grace official, evaluated the results. On April 24th, 1985, Grace released the results, saying that "no hazard exists due to chemical residues on the site." (Boston Globe, 4/25/85). The announcement was made at a public meeting. About 35 local residents showed up, expressing concern that organic chemicals used in Grace's operations are now in the soil and ground water of the area. Grace makes particularly heavy use of benzene, naphthalene, and acetone (Globe, 4/25/85). Although Grace has labeled these non-priority chemicals, they are in fact on the EPA's priority chemicals list. Construction on the site would be sure to raise dust and bring these contaminants to the surface, citizens said. Once there, they would escape into the air, or leach into the local water table, via surface runoff. The Boston Globe covered the contradictory nature of the meeting:

Dr. Raymond Herbison, a Grace official who evaluated the tests, told the group that the site "does not represent a health risk at the present time, mainly because there is no exposure" to the chemical constituents detected in the area, most of which, Herbison said, did not exceed safety guidelines.

In only a few instances, Herbison said, did the levels exceed safety guidelines. (my emphasis)

These levels were not revealed.

The state listed 62 Whittemore Ave., the Construction Products Division, as a suspected hazardous waste site only two years later (Boston Globe, 1/15/87). Three years have now passed since the DEQE targeted this area for study. I was not able to find any sources about its current status, or what, if anything, is being

done to clean up the contaminated soils and water, if in fact they are contaminated. In the manner of Grace's study, I decided to collect water and soil samples from the site and test for naphthalene.

NAPHTHALENE

Naphthalene is a bicyclic aromatic hydrocarbon. Its chemical formula is $C_{10}H_8$ and its molecular weight is 128.16. It has a boiling point of $218.87.5^{10}^{\circ}C$, and a melting point of $80.5^{\circ}C$ (Weast, 1986). While the acute lethality of naphthalene can be achieved through different routes in different species (Table 1), the EPA has not been able to arrive at a valid naphthalene water criterion (EPA, 1980). The ACGIH (1971) presented a threshold limit value of 50 mg/m^3 for humans exposed to industrial emissions of naphthalene (EPA, 1980). This was determined to prevent eye irritations only. Naphthalene is a suspected carcinogen, and the EPA has suggested that it should be "regarded with concern." (EPA, 1980). This is a mild warning.

METHODS/MATERIALS

COLLECTION

After an initial foray onto W.R. Grace property in late March, I returned to Williams only to find that I had improperly collected my samples to test for organic compounds. I had used plastic bottles. Plastic traces can leach into the sample and interfere with the gas chromatography scan. I returned to Cambridge on 14 April to re-collect water and sediment in special amber glass jugs with teflon-coated caps.

After surveying the area, I selected four places to take soil samples and two for water samples (see Fig. 1). Site #1 was located to the back right corner of One Alewife Center (see Fig. 4). It is a shallow ravine which holds water after it rains and always wet just below the surface. This area held many wetland indicator species, including rushes (*Juncus effusus*), cattails (*Typha*

TABLE 1.
TABLE-5

Tests of the Acute Toxicity of Naphthalene

Test Animal	Number	Route	LD ₅₀ (mg/kg)	Reference
Mice	--	Subcut.	5,100	Irie, et al. 1973
Sherman rats				
male	40	Oral ^a	2,200	Gaines, 1969
female	40	Oral ^a	2,400	Gaines, 1969
male	10	Skin ^b	2,500	Gaines, 1969
female	10	Skin ^b	2,500	Gaines, 1969
Rat	--	Oral	1,780	NIOSH, 1977
Rat	--	Oral	9,430	Union Carbide Corp., 1968
Rat	--	Inhalation	100 ppm x 8 hr.	Union Carbide Corp., 1968

^a Dissolved in peanut oil
^b Dissolved in xylene

from EPA 440/5-80-059, Ambient Water Quality Criteria for Naphthalene. October 1980.



Fig 4.1

Site #1

(sediment)



Fig 4.2

Site #3 *

(sediment)

* There is no site #2... samples taken in March included 5 samples - upon return in April, site #2, a drainage ditch, was excluded due to logistical problems (only 4 sediment bottles!) Note wet patches at site #3 - on April 14 there

latifolia), dogwood (*Cornus stolonifera*), and tansy (*Tanacetum vulgare*). I took a soil sample (~500mL) from this area.

Site #3 was farther back, adjacent to the dump (see Fig. 4). This marshy land had pools of water, dry reeds and grasses. Although there was no visible surface water on 14 April, I was able to detect rivulet patterns and took my sample from the spot where water seemed to collect. As I brushed away the reeds, an overwhelming stench rose from the ground - a cross between raw sewerage and a skunk. Pew!

Site #4 was across the street, by site #1 (see Fig. 5). It is an enclosed pond, with a small inlet that probably accepts surface runoff from the wetlands. The water here was dirty and smelled of sewerage. Wetland plants included *T. vulgare*, hardhack (*Spirea latifolia*), Queen Anne's Lace (*Daucus carota*), aster (*Aster*), evening primrose (*Oenothera biennis*), and various sedges and grasses. Chemical bottles and other debris were washed up on the shore. A soil sediment was taken from the inlet, and a water sample (5 L) as well.

Site #5 was near site #3, in a water channel (see Fig. 6). Culverts at the right end accept inflow from Yates' pond, and the water flows to the left, past an industrial sector into Jerry's Pond. Noticeable vegetation included willow (*Salix*), cattails (*Typhus*), reeds and grasses. Water and sediment samples were taken. The water here was the most foul. It smelled, was a murky yellow/brown, and had clumps of algae and a thick scum floating on the surface by the shore.

EXTRACTIONS

The first step in analyzing the soil and water was to test the solubility of naphthalene in different ^{solvents} solutions to determine what would be the most effective solvent for the extraction process. As naphthalene has been shown to be soluble in organic solvents (Spector, 1956), I selected the common solvents hexane, hexane/acetone, acetone, and methylene chloride (see table 2).

SOIL

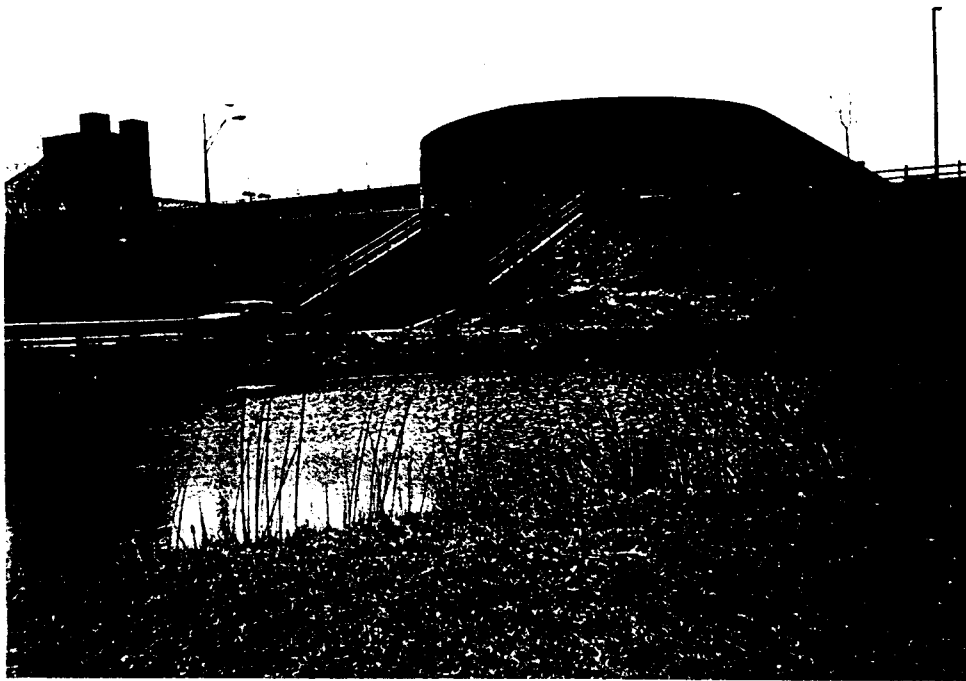


Fig 5.1
Site #4
Enclosed pond.



Fig 5.2
Site #4 (sediment/H₂O)
Bank w/ inflow containing runoff from site #1.

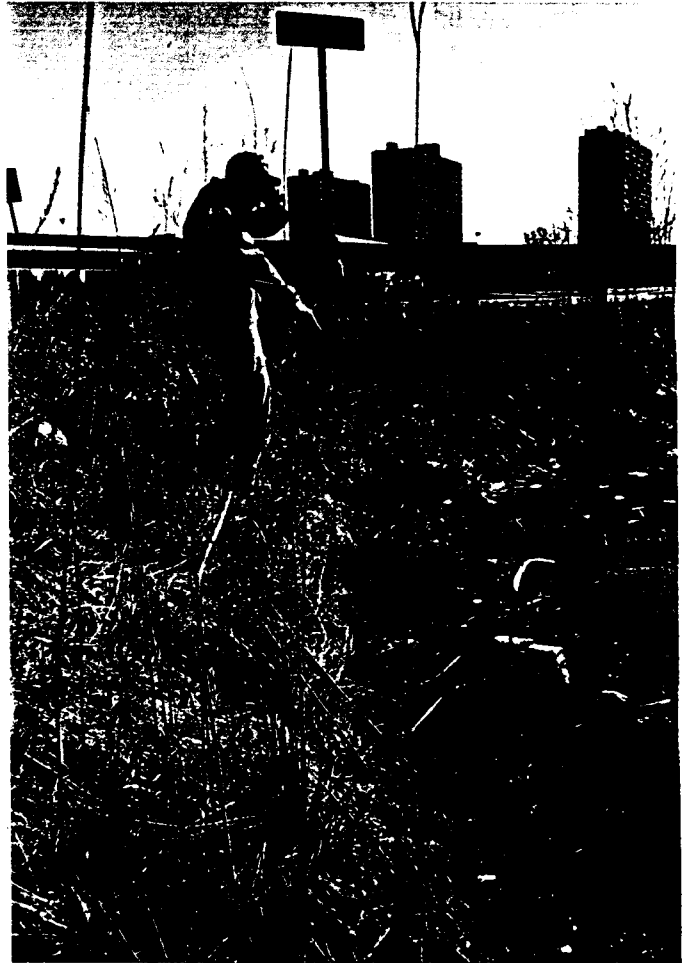


Fig 5.3
Joe Citizen, shocked at litter, algae,
foul stench.

Figure 6.

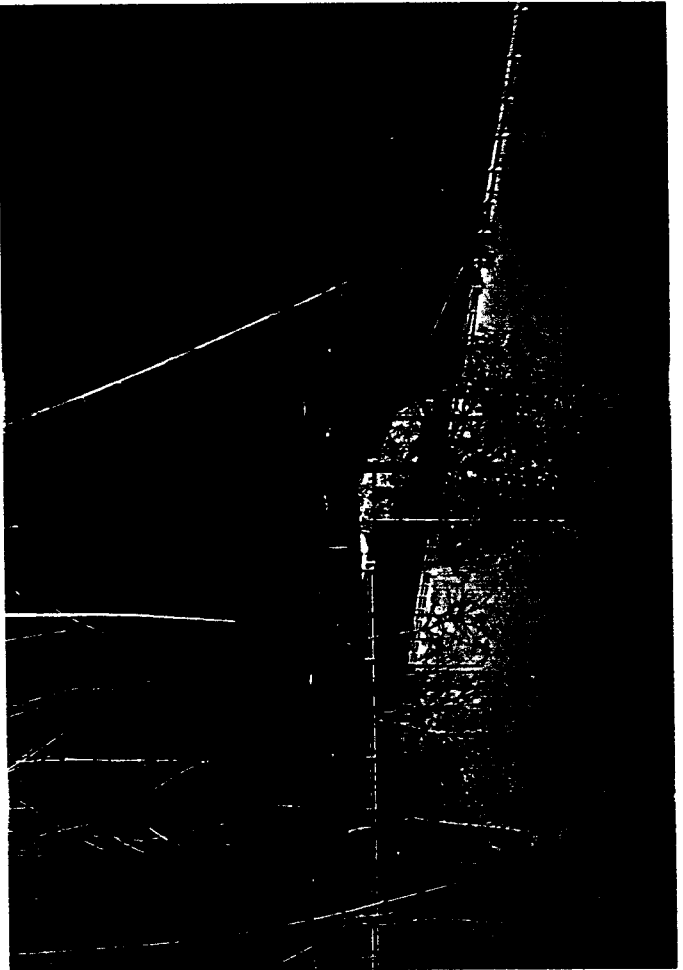


Fig 6.1
Site #5 (sediment H_2O)
Note culvert - inflow
from Yates Pond.



Fig 6.2
Other end of Site #5 -
drains down into
Jerry's Pond.

Fig 6.3
The murky brown glop.

SOLUBILITY CHART

0.1 g $C_{10}H_8$ → 3.0 mL meth. chloride	most soluble GRADIENT least soluble	> immediate — rapid — slow
0.1 g $C_{10}H_8$ → 3.0 mL acetone		
0.1 g $C_{10}H_8$ → 3.0 mL hexane/acetone		
0.1 g $C_{10}H_8$ → 3.0 mL hexane		

Hexane, hexane/acetone mixtures needed to be shaken.
 The dissolution rate in hexane was noticeably slower than in the other solvents, so it was discarded.

Another 0.1 g $C_{10}H_8$ was added to the solvents.

1. meth. chloride : immediate dissolution, denser than $C_{10}H_8$
2. acetone : } similar rate (slower), $C_{10}H_8$ denser
3. hexane/acetone : }

A final 0.1 g $C_{10}H_8$ was added to the solutions, with similar results: however, hexane/acetone and acetone seemed to be reaching supersaturation as the precipitate took longer and longer to dissolve.

Result:

meth. chloride (CH_2Cl_2) chosen as extractive solvent.

SOIL

The dry weight of each sample was determined by weighing out 3 g of the soil and reweighing after drying out in an oven for ~2 days (see table 3). Next 30 g of each soil sample was weighed out into a 500mL beaker. Excess water was poured off, 100 mL of CH_2Cl_2 was added, and two teaspoons of anhydrous sodium sulfate (Na_2SO_4), to absorb any remaining water. The mixture was roughly chopped up and sonicated for 3 minutes. This process aided in drawing the naphthalene out of the sediment and into the methylene chloride. After sonication, the supernatant liquid was poured off into a Buchner filtration apparatus. This process was repeated twice more. The third time, all of the sample was poured into the funnel and 25 mL of CH_2Cl_2 was added, in an effort to filter all of the naphthalene out of the soil.

After filtration, another two teaspoons of NaOH were added to the filtered liquid, swirled, corked, and allowed to rest for five minutes. During this time I was forced to switch my choice of solvent, as the Chemistry department had misplaced Prof. Kegley's only case of methylene chloride. She suggested a switch to hexane might be appropriate. Although I disliked switching solvents in the middle of an experiment, it did not interfere with my results, and actually aided in concentrating the sample (as explained further on).

The solutions were then filtered through a Florisil separatory funnel, and rinsed twice with two 20 mL rinses of hexane. Before this filtration, the solutions greatly varied in color as follows: #1, deep amber, #3, light amber, #4, yellow tinge, #5, yellow amber. After the Florisil process, much of the organic colorants were separated out in ~~the rinse through~~ distillation with hexane, so the solutions had a more uniform color: #1, deep marigold-y yellow, #3, light yellow, #4, very clear, #5, very clear. All four solutions were translucent. ? transparent but it is obvious that the first two and the latter two share some of the same physical properties.

Next the solutions went through the Kuderna-Danish concentrator. This steam bath removed most of the CH_2Cl_2 diluting the naphthalene. After the sample boiled down to ~5 mL, another 50 mL of hexane was added to the K-D boiling tube. The solution was boiled again to get rid of all the CH_2Cl_2 and concentrate the

TABLE 3.

% MOISTURE IN SOIL SAMPLES

sample #1	:	59.59.
sample #3	:	21.76%
sample #4	:	17.01%
sample #5	:	20.26%

Calculations:

$$\begin{array}{l}
 \text{sample \#1.) crible + sediment: } 29.546 \text{ g} \\
 \text{crible weight: } \underline{22.656 \text{ g}} \\
 \text{wet sediment: } 6.89 \text{ g}
 \end{array}$$

Baked in ^{oven} ~~tin~~ for 52.5 hours: ↓

$$\begin{array}{l}
 \text{crible + sediment: } 25.45 \text{ g} \\
 \text{crible weight: } \underline{22.656 \text{ g}} \\
 \text{dry sediment: } 2.794 \text{ g}
 \end{array}$$

$$\frac{2.794 \text{ g}}{6.89 \text{ g}} = \frac{x}{100} \quad x = 78.24$$

$$\% \text{ moisture} = 59.59.$$

naphthalene even further. This solvent exchange of hexane for methylene chloride was necessary as the gas chromatograph (GC) works optimally with hexane - thus switching from CH_2Cl_2 to hexane earlier in the filtration process really made no difference at all.

I now had four concentrated samples of between 7.2 and 10.0 mL. These were further concentrated by directly placing them on the steam bath until they reached a volume of ~1.5 mL. The colors gradient remained about the same between the samples, although it intensified in depth. #1 was a deep red-orange, #3 a clear orange, and #4/#5 ~~clear~~ ^{colorless}.

WATER

The process used to extract naphthalene from the water samples varied a bit from the method for soil. 900 mL of water was mixed with 300 mL of hexane in the following manner:

1. The 900 mL of water was separated into three 300 mL volumes.
2. The 300 mL of hexane was separated into nine 33.3 mL volumes.
3. 300 mL of the samples was poured into a separatory funnel, and then 33.3 mL hexane added. The funnel was shaken by hand to allow complete mixing of the liquids.
4. The density of pure H_2O is greater than the density of hexane, so it would sink in the funnel and ^{was} drained off into a beaker. The hexane solvent, which had attracted naphthalene in the mixing process, was then poured out into another beaker. The water was then poured back into the funnel, another 33.3 mL of hexane added, and the process repeated again.
5. Each 300 mL of water was thus treated with 100 ^{total} mL of hexane. This process is very effective in extracting naphthalene from the water into a proven solvent. I added about two tablespoons of ^{soy} ~~NaOH~~ into the beaker containing the hexane/naphthalene mixture, which was then corked, swirled, and allowed to take up any remaining traces of water. ^{The sample}
6. The procedure then follows that for soil samples. ~~It~~ is concentrated in the K-D apparatus, and boiled down to a final volume

of ~1.5 mL. There is no need for solvent exchange. The extracts were named #W4 and #W5 to distinguish them from soil samples. Both solutions were clear, with the faintest hint of yellow.

ANALYSIS

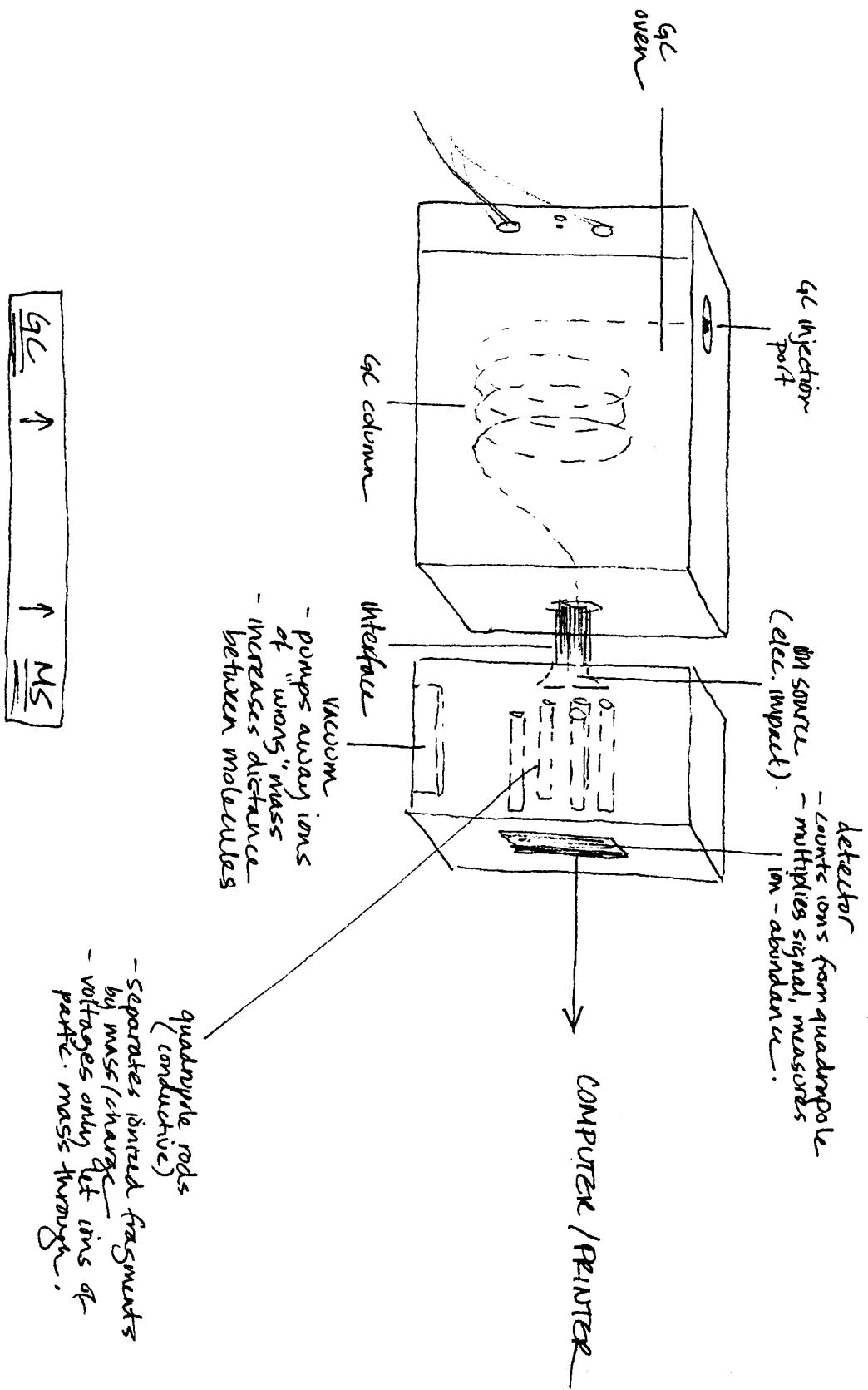
I used the gas chromatograph/mass spectrometer (GC/MS) in the selected ion monitoring mode (SIM) to perform a qualitative analysis for the presence of naphthalene.

Gas chromatography is the physical separation of compounds of different polarities and boiling points (Hewlett Packard, Kegley, 1991). As a sample is injected into the port, it is vaporized and a carrier gas (He) whisks it away, down onto a separating column. A ~~mass spectrometer~~ ^{mass spectrometer} detector then takes the column eluent, recording and measuring its electronic signal (see Fig. 7).

The MS is a specialized kind of GC detector. It is an additional step between the traditional GC column - detector process. The MS takes the column eluent and bombards it with ^{electrons} ~~energy~~. The molecule suffers an electron loss and charged ions and ^{neutral} molecule fragments are formed. The fragments continue to break up or rearrange into stable fragments. The MS detector measures and records the masses of each ionized fragment, resulting in a "unique fingerprint of molecule that can be used in identification." (Hewlett Packard, 23-5954-8218).

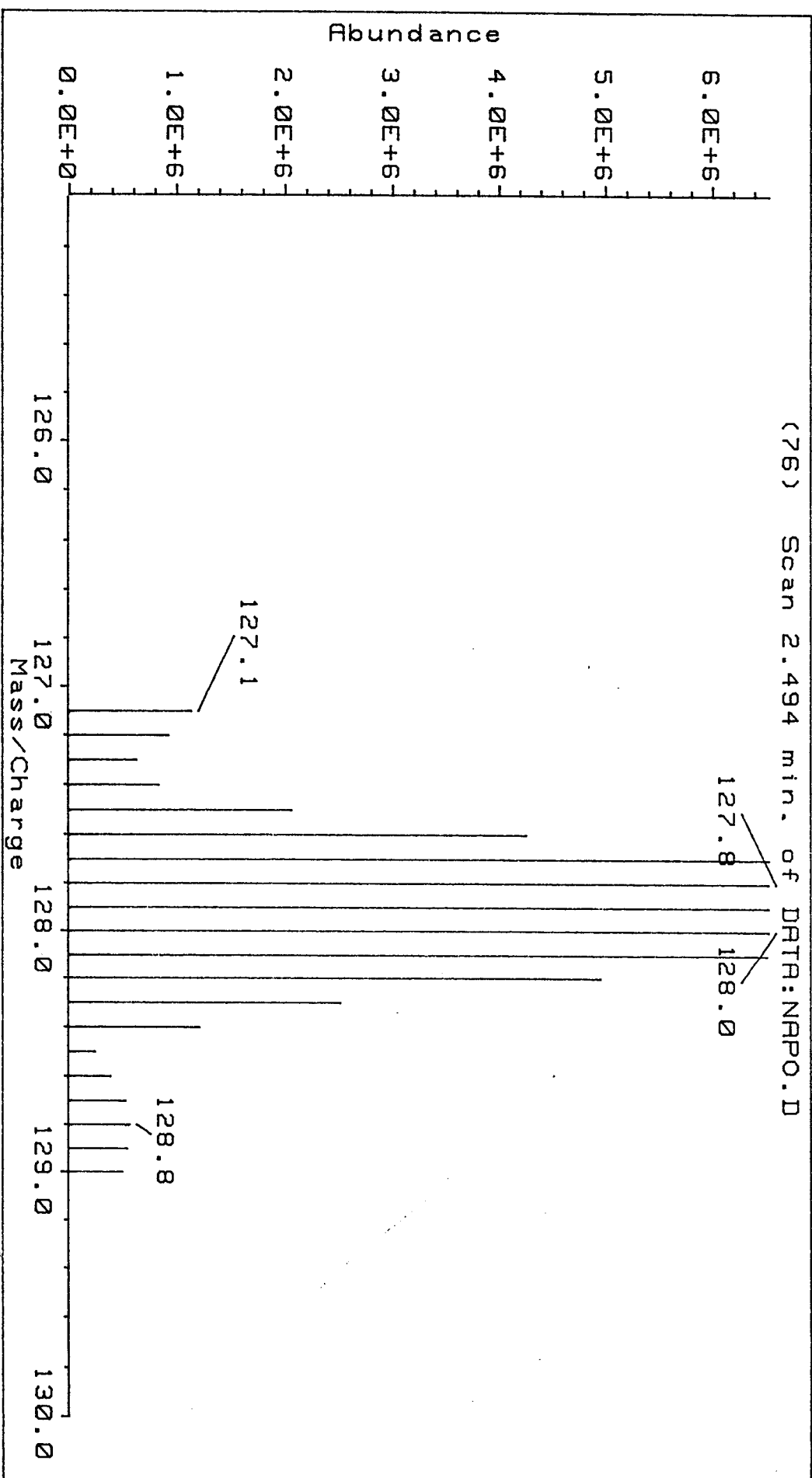
Let's talk here The graph of this GC/MS analysis plots ^{signal intensity} ~~abundance~~ vs. ~~mass~~ time and is called a total ion chromatograph (TIC). A naphthalene standard was made up and injected into the GC/MS. A scan acquisition of the standard was run (50-500 amu @ 0.86 scans/second). Since the molecular weight of naphthalene is 128.16 amu, we expected to see a base peak at this mass/charge, and were proven correct (see Fig. 8). A SIM seemed appropriate, for it measures trace amounts in a mixture (Hewlett Packard, 23-5954-8218) and we could limit our scan to the range of 127.7 - 128.1 amu, where the standard showed greatest abundance (99.73-100%). ^{% of the base peak} The other advantage to this particular ^{method} SIM was that the naphthalene peaked at ~2.5 minutes, and so each run was complete within five

Fig. 7



21.

Fig. 8



minutes. The standard TIC was run, and then scans and TIC's for all six samples (Fig's 9 - 21).

RESULTS

All six samples contained naphthalene. The scans for the four soil samples clearly show ^{what} the ~~ion~~ detector noted naphthalene at ~128.0 amu. The TIC shows ^{the} ~~the significant mass peak~~ that rises from the baseline at ~2.5 minutes, when the ~~scan hit the mass/charge~~ ^{can could eluted from the GC} 128.0. The one aberrance here is that the run on soil #4 ran for 7 minutes (human error), which makes the peak look different from the others. It would have been useful to correct all the y axes to the same range of abundance for comparative purposes, but this was difficult due to computer recalcitrance.

The water samples resulted in some very bizarre graphs. While it is clear by the scans that there is indeed naphthalene present in these samples (Fig's 18, 20), The TIC's only registered a dot to indicate a peak, and there was no baseline at all. I attribute this to computer wierdness.

INTERPRETATION

Quantitative analyses are always more interesting than qualitative ones. The reader is left feeling, "yes, but how **much** naphthalene is present in the samples?" Once the initial thrill of discovering the presence of toxics in the soil and water of my hometown passed, I too began to itch with questions, wanting numbers to compare to government statistics. However, a quantitative analysis would have required much time - too much for a college student and her overworked professor. To perform a thorough investigation using the SIM, it would have been necessary to make up a series of calibration curves. By injecting known amounts of standards into the GC and recording the response of the MS for each, I would have obtained these curves. My samples could then be injected and the amount of naphthalene present calculated by relating its response to the different curves. This would be an excellent idea for a future study.

Fig. 9

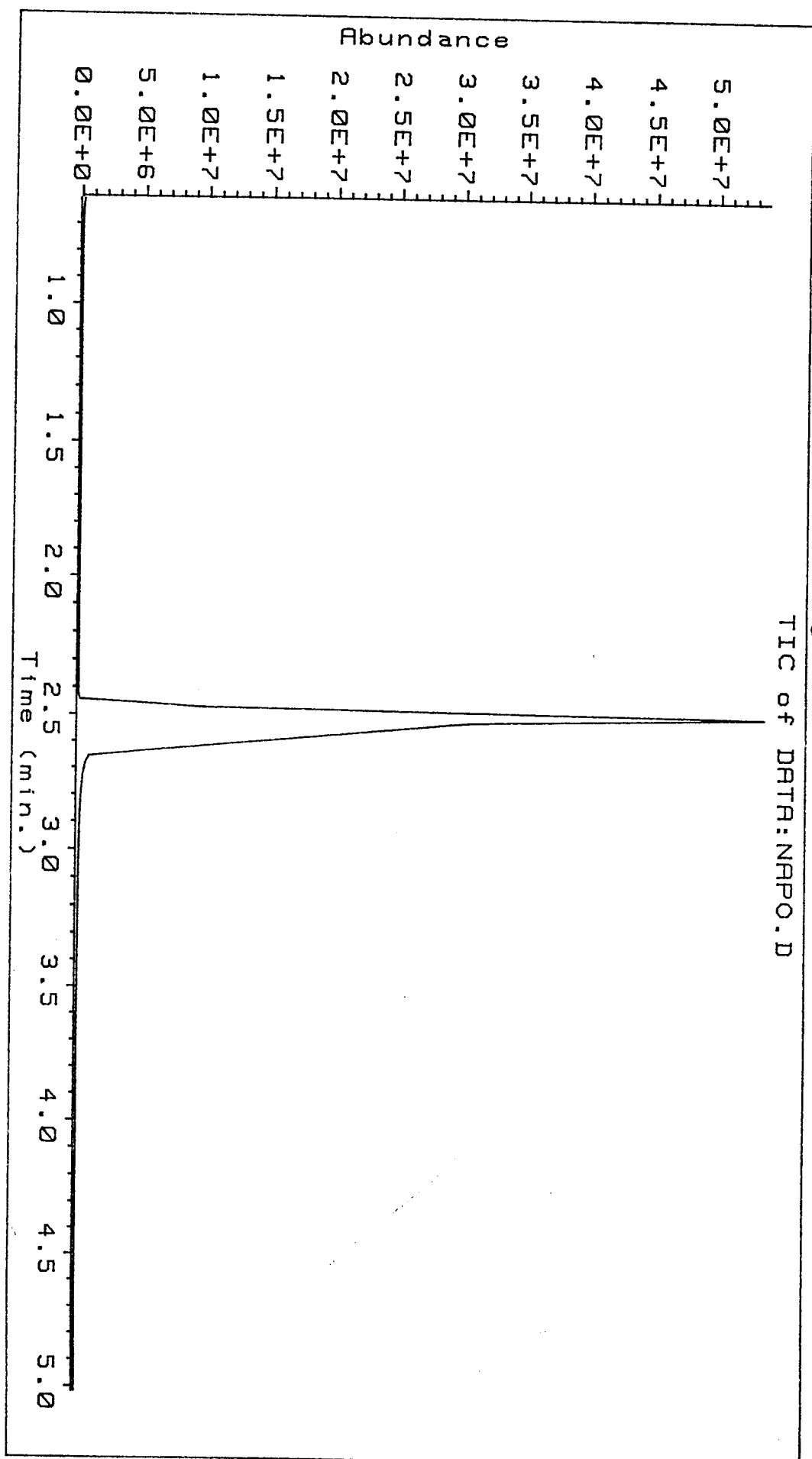


Fig. 10

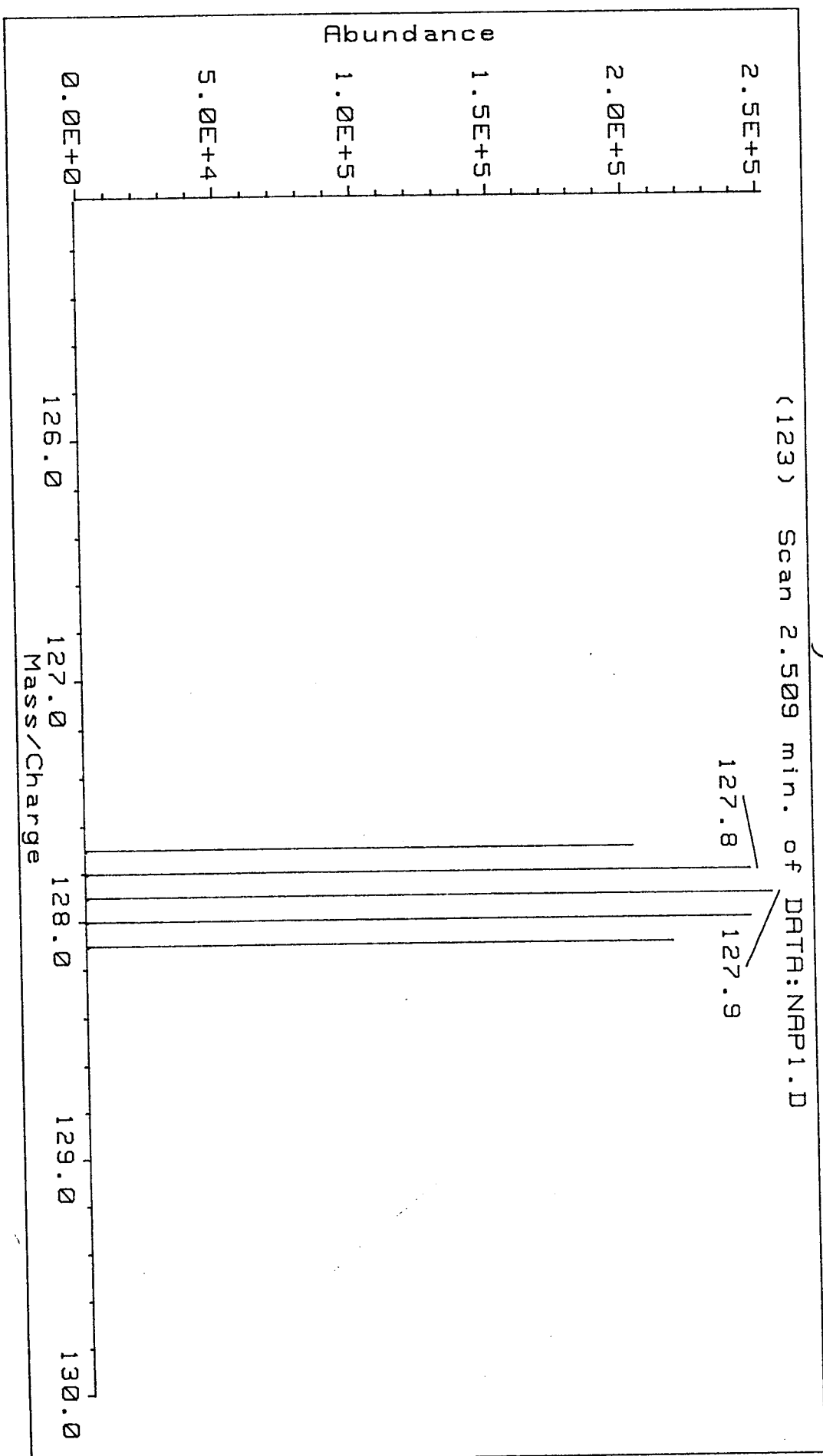


Fig. 11

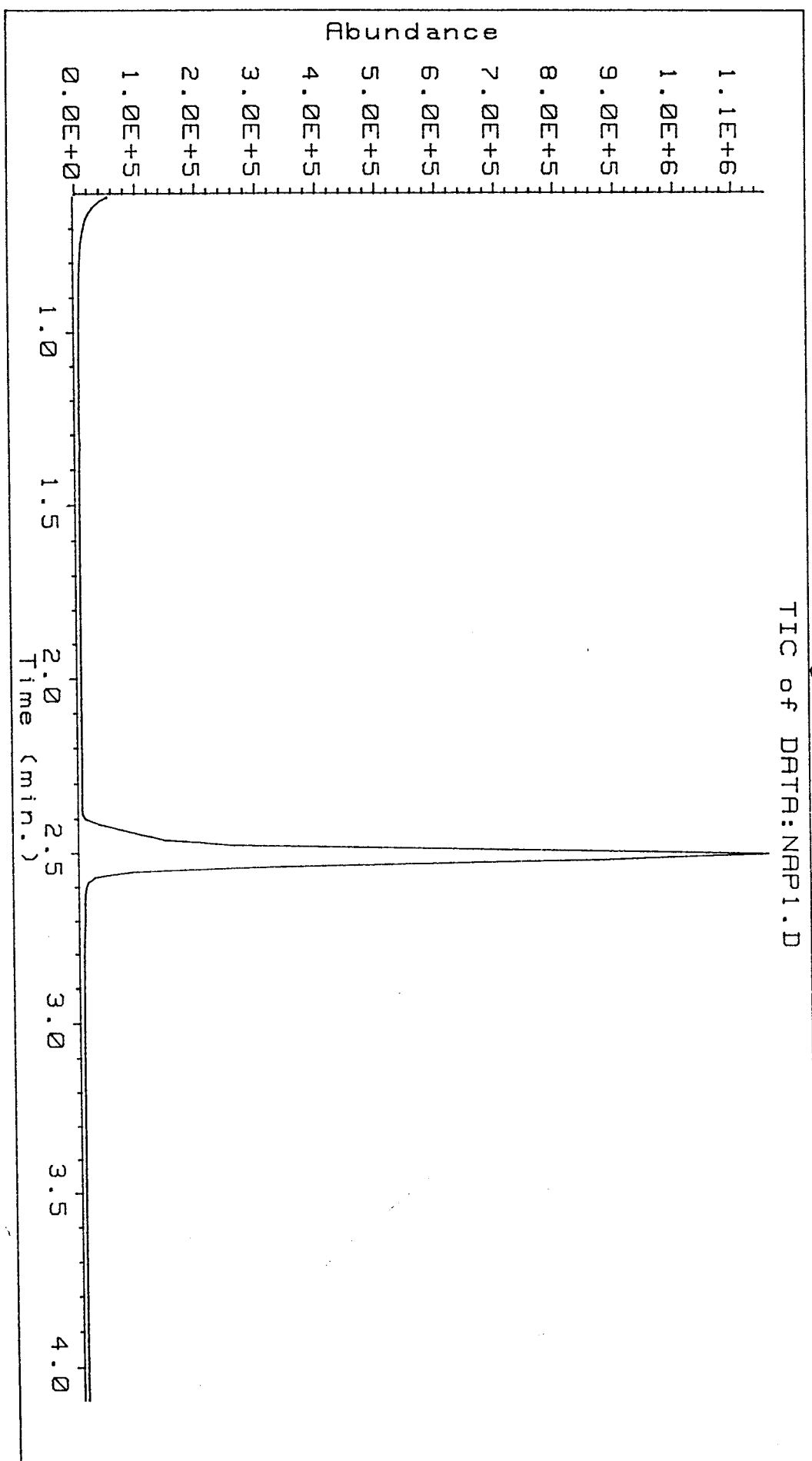


Fig. 12

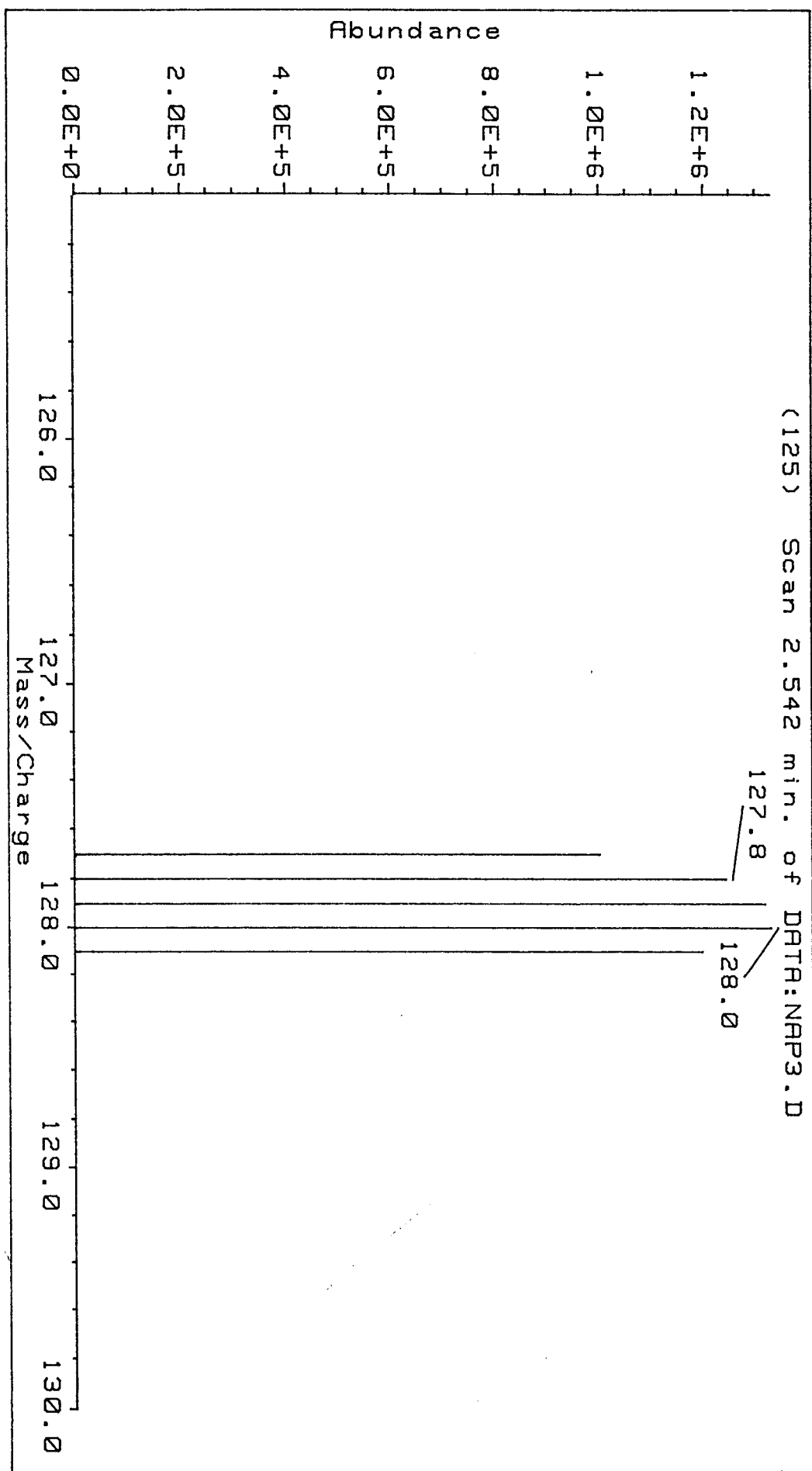


Fig. 13

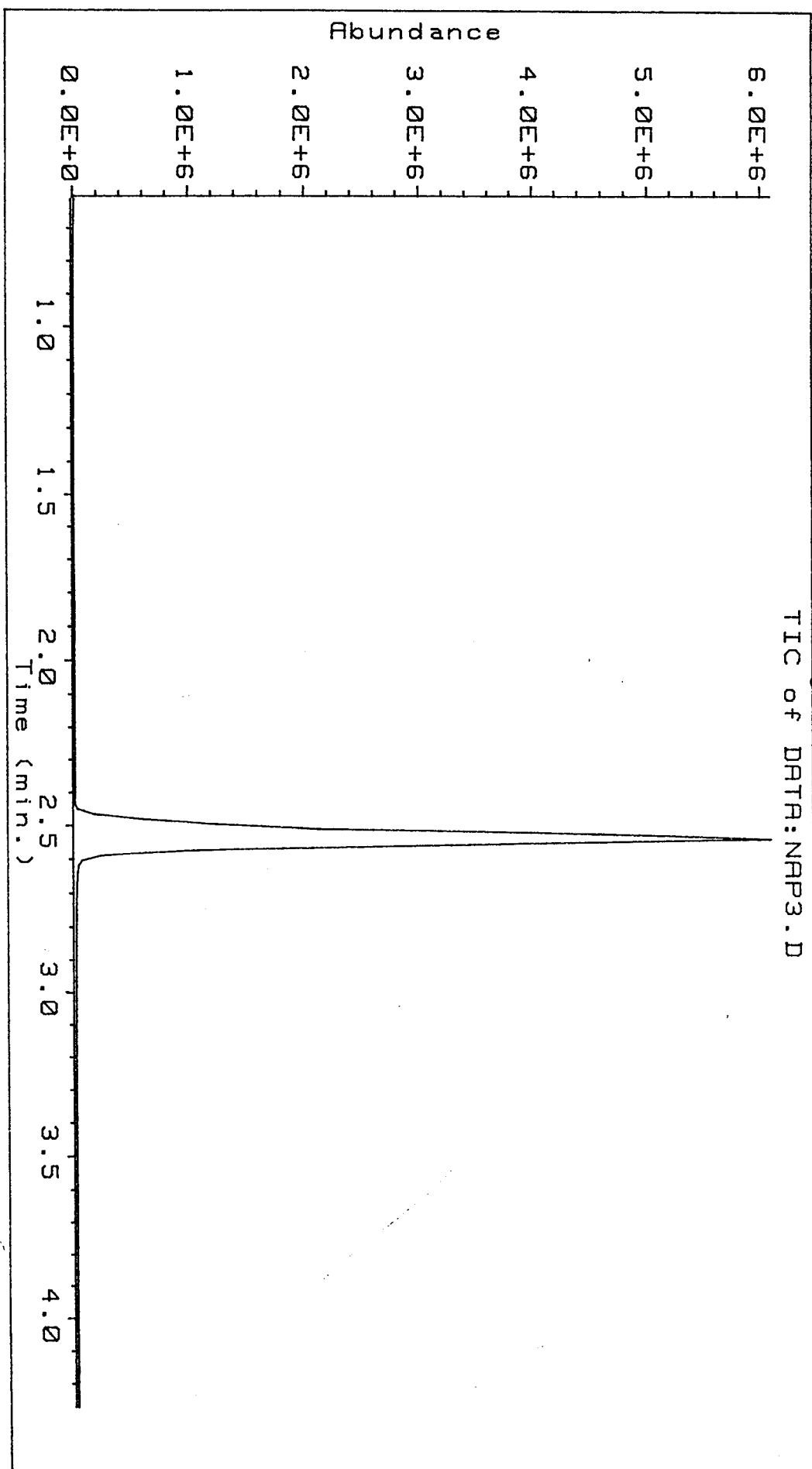


Fig. 14

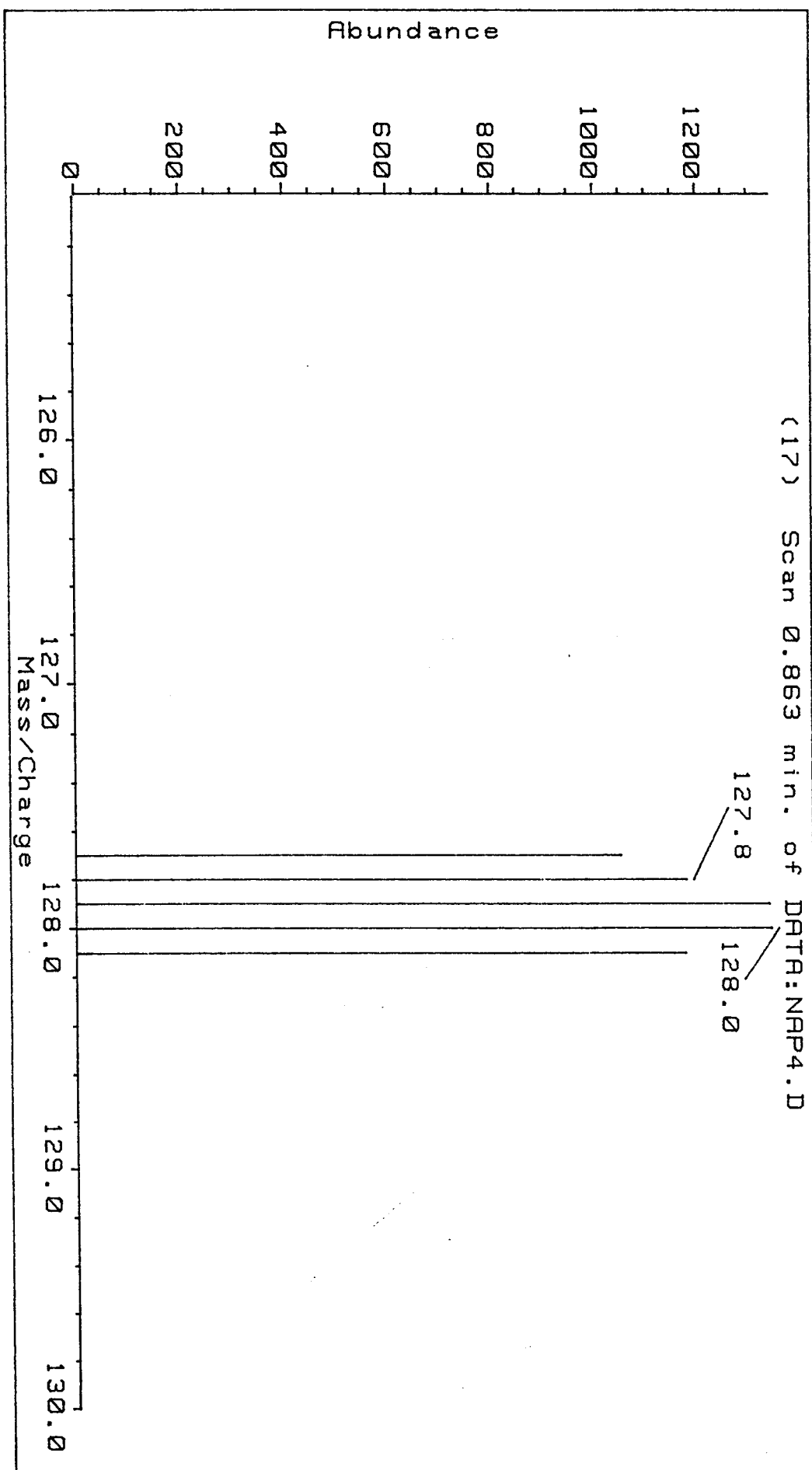


Fig. 15

TIC of DATA: NAPHTH#4.D

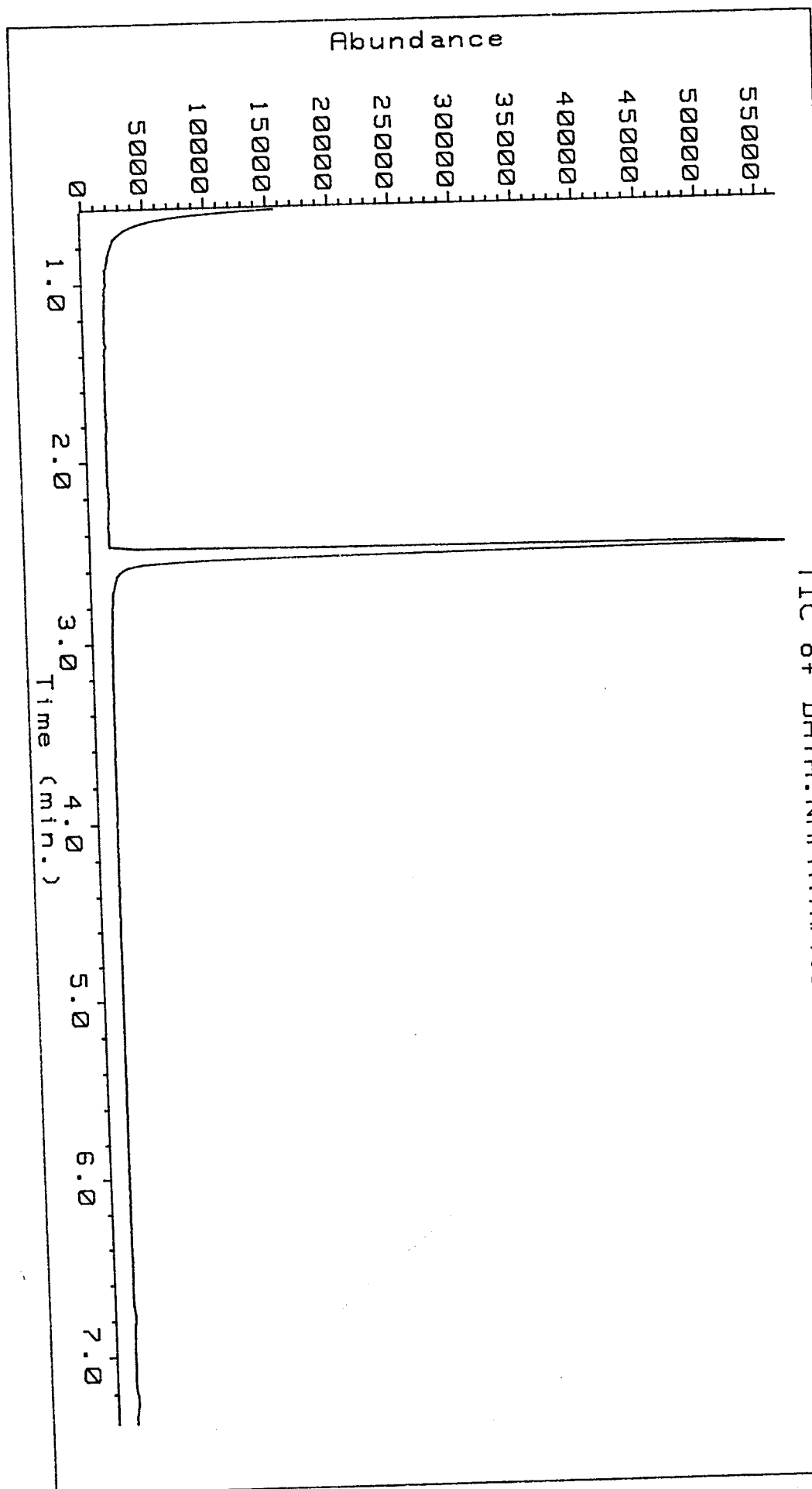


Fig. 16

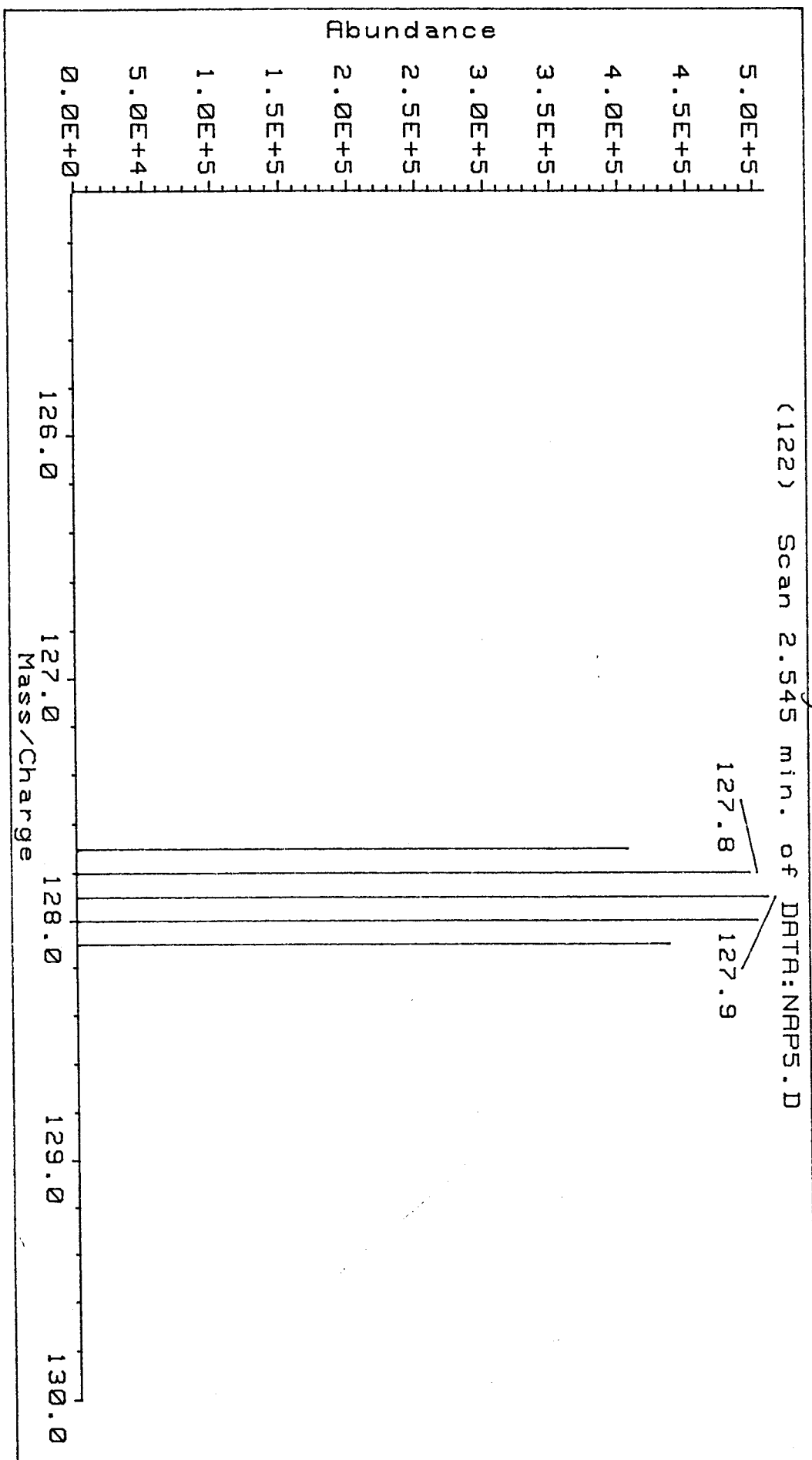


Fig. 17

TIC of DATA: NAPS.D

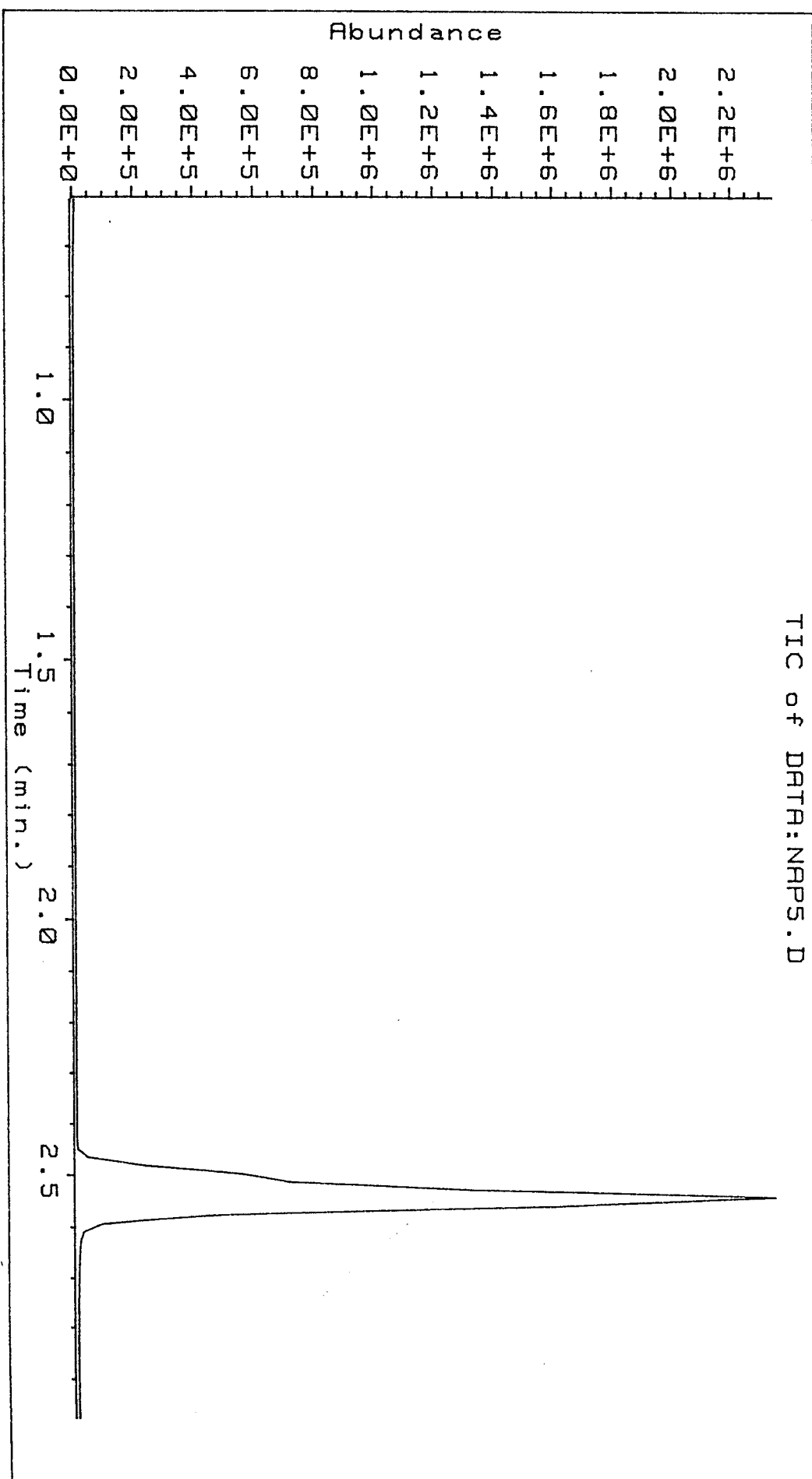


Fig. 18

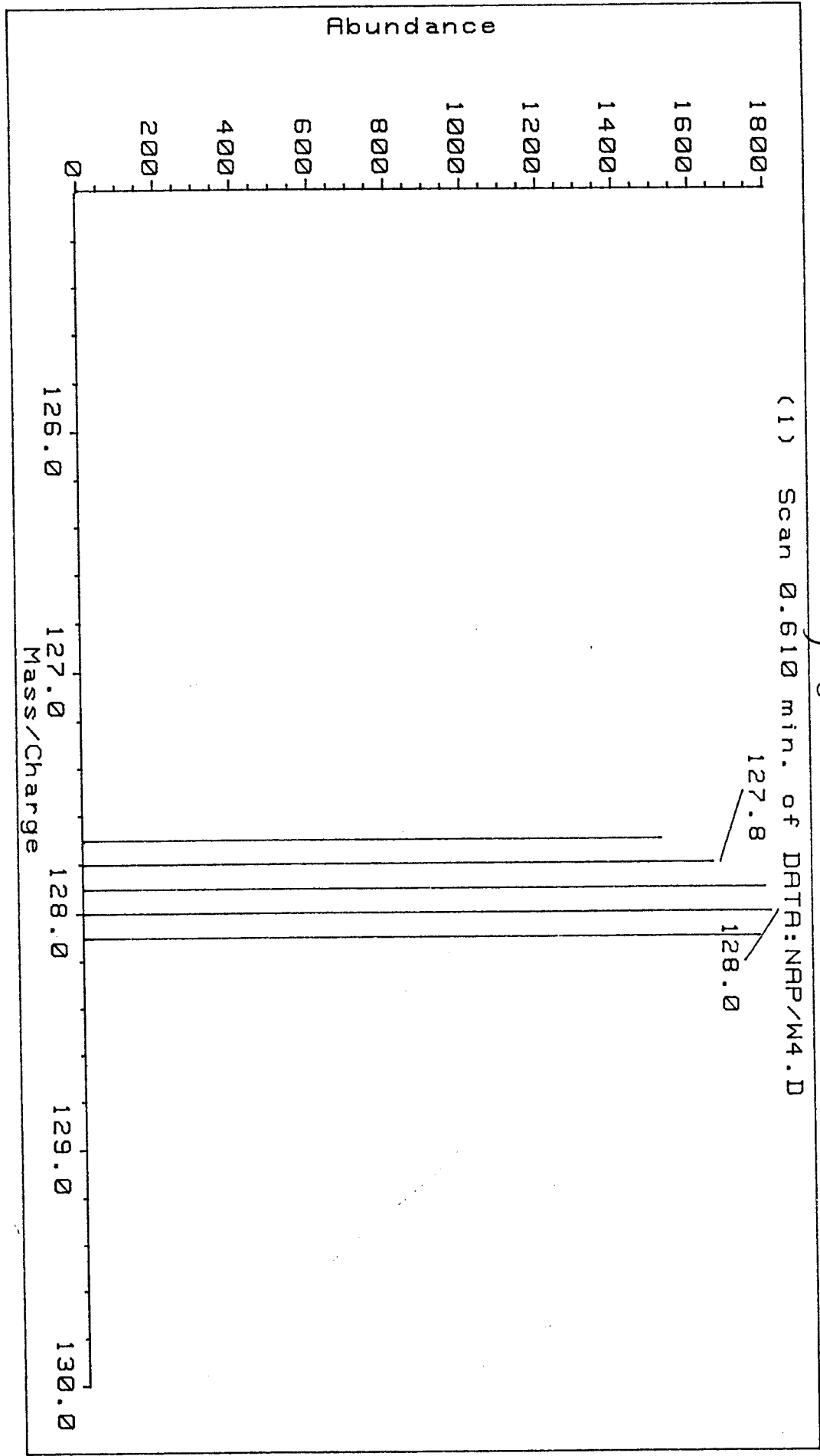


Fig. 19

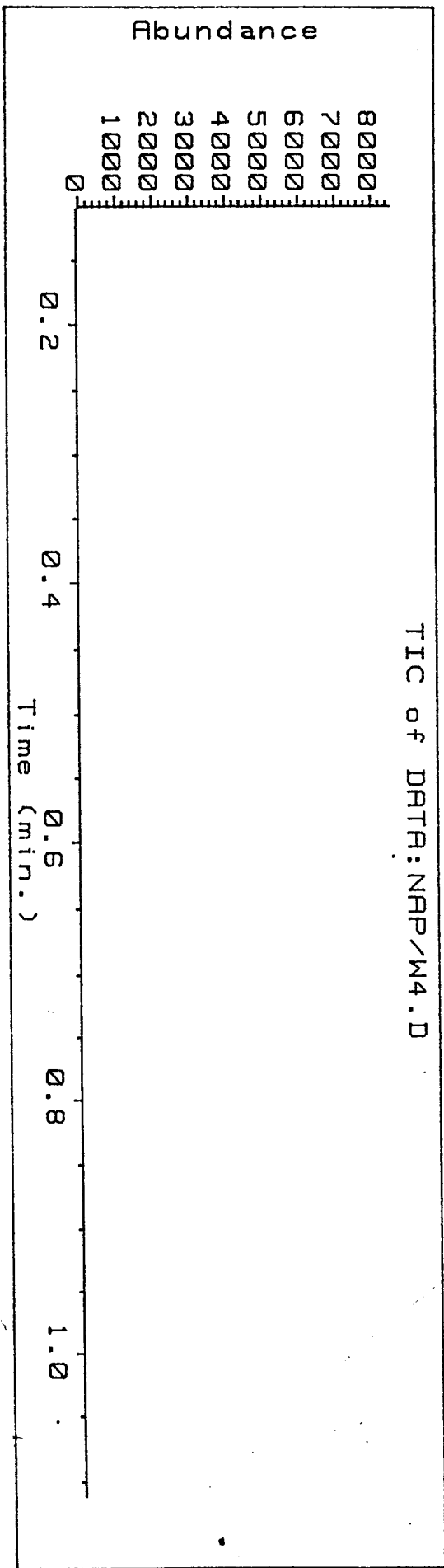


Fig. 20

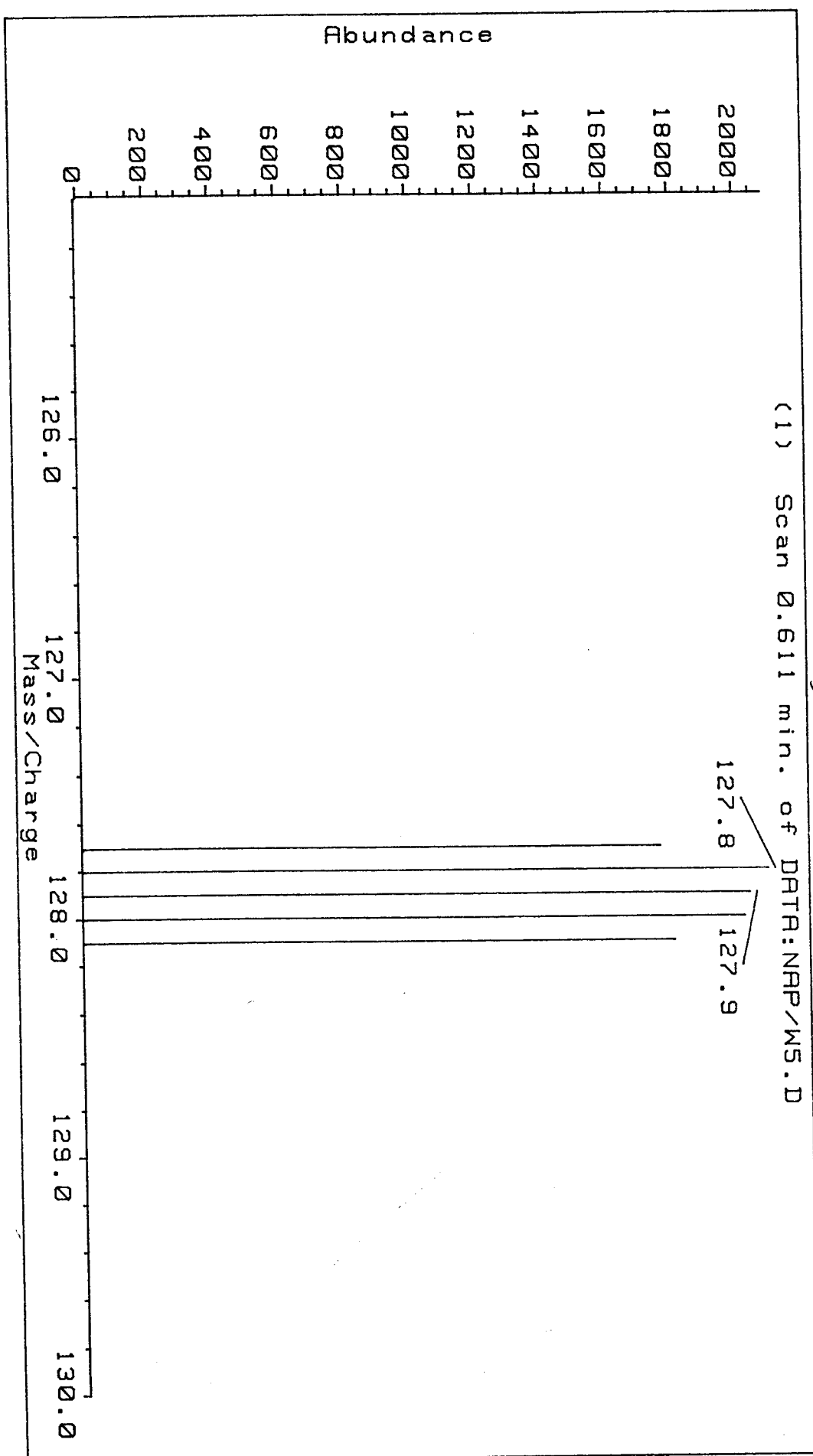
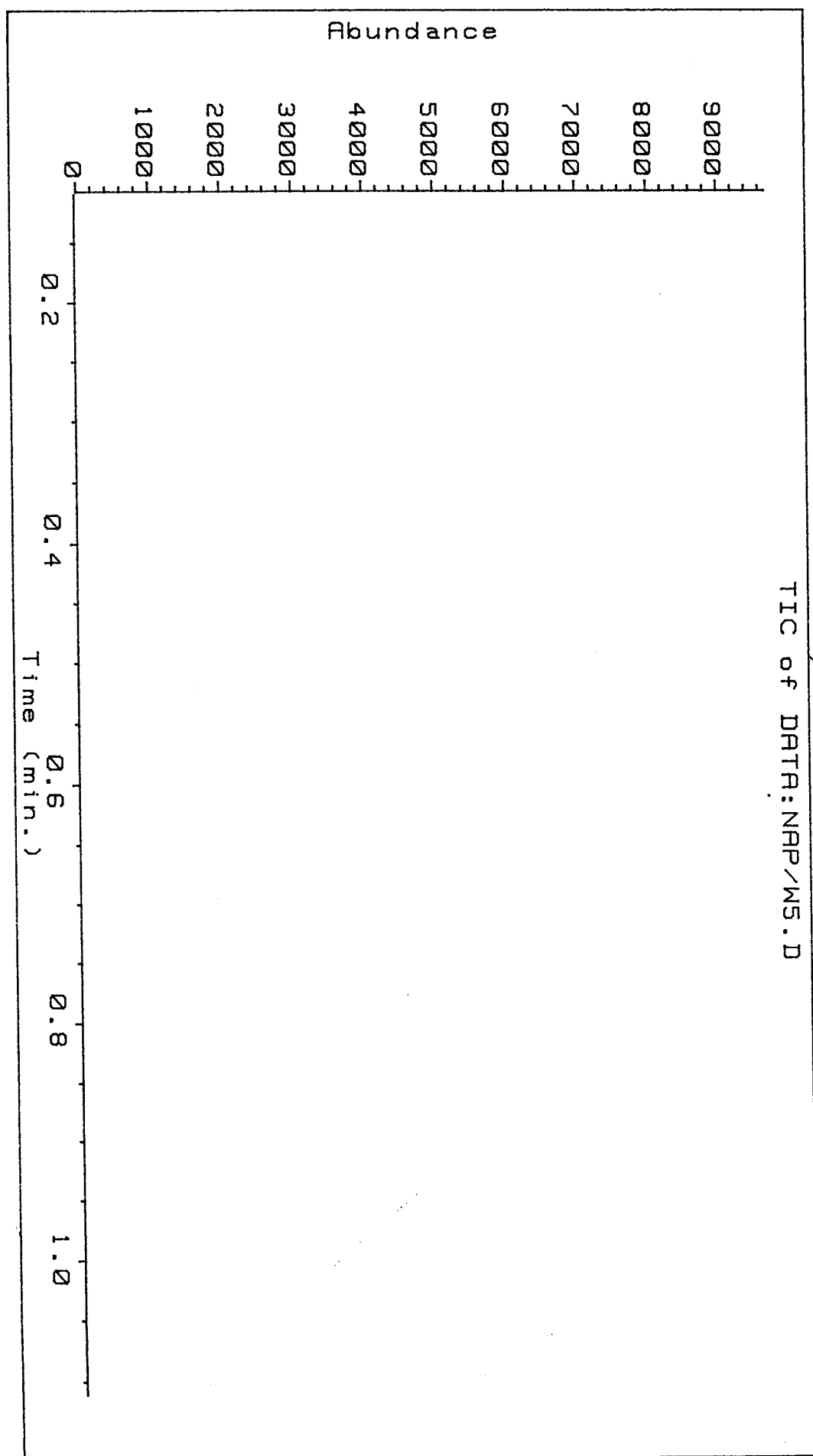


Fig. 21

TIC of DATA:NAP/W5.D



While I cannot quantitatively assess the specific concentration of naphthalene in each sample, I can make a series of general conclusions. The relative abundance of naphthalene in the samples proceeded as follows, from least to most: #W4 (8500), #W5, #4, #1, #5, and #3 ($6.0E + 6$). The water samples are likely to contain the least naphthalene as it is a hydrocarbon, ^{insoluble in water + less dense,} and thus floats on water. Once it has entered a large body of water, such as sites #4 and #5, it can float away down through various water channels into the drainage basin. Also, these water bodies are part of an interconnected series of ponds, and thus contamination will stem from a number of sources. It would seem, however, that site 4 would have more naphthalene than site 5 as it is an enclosed pond. Site 5, on the other hand, is closer to the old dump.

I expect that there would be greater concentrations of naphthalene in my soil samples than my water ones. I was not able to find any information on the properties of naphthalene in soil. Is it more likely to stick to sediment particles or leach down into the water table? Although I do not know these answers, I was able to make some qualified guesses to the reasons behind the varied abundances.

#4 was the least abundant. The extraction had been ^{colorless} clear, pointing to the nature of its soil composition; ^{inorganic} geologic rather than organic. This site was by the pond, and the runoff came from the wetlands of site 1. I would expect the abundance of naphthalene, then, to be higher at site 3, as it was. The extract #3 had been a deep red-orange, indicating heavy organic material. Either organics ^{inorganics} hold more naphthalene than geologics, or some chemical dumping had occurred at this area, which is likely. Good conclusion

There was a greater abundance of naphthalene at site 5. The extraction had been clear, as the soils along the bank contained little organic matter (most washes off into the water). Where does the runoff to the bank come from? Site 3, and the dump. Site 3 clearly had the highest relative abundance of naphthalene. The orange color of extraction #3 pointed to the organic nature of this marshy area. This soil should be heavy in naphthalene, and by extension, the dump should have the highest concentration of all.

Having trespassed on W.R. Grace property to obtain my samples, I didn't want to scale the fence and take samples from the dump - however, after this analysis, I would love to analyze that sediment. Unlike water, it is easy to pinpoint one contaminator for toxic soils - and I suspect Grace truly did dump its byproducts directly over its back fence.

CONCLUSION

W.R. Grace is incontrovertibly the source of much pollution in eastern Massachusetts. On January 31, 1991, it closed its Acton plant, relocating to Kentucky where environmental regulations are less severe. Closing a plant, however, will not aid the MA citizens who have worked for or live near Grace. Clean-up is the essential factor, and that is not evident in Acton, or Woburn, or Cambridge. If the MA economy enters a recession, the DEP is not going to be able to afford even surface cleanup.

MA environmental officials called for businesses to take on responsibility for their contamination of ground, air, and water last December (Boston Globe, 12/17/90). A report was released by the DEP stating that **less than 25%** of 4,200 hazardous waste sites in MA are being cleaned up at the present time (Globe, 12/17/90). These figures are shocking. For the neighborhood kids who swim, play, and fish in Jerry's Pond, Grace's lack of responsible action may prove fatal. If naphthalene is present in the area, it is a safe guess to ^usuppose benzene and acetone are also present. The filth and stench, scum and debris are enough to warrant further investigation by the DEP or independent citizens.

The men and women who work at One Alewife Center and Grace's Construction Products Division have the right to demand a safe workplace, free from hazardous waste contaminants. This area of Cambridge, however, is a lower-class working neighborhood, where people often do not have the luxury of buying bottled water or risking their job by voicing complaints. It is up to independent parties to spur the research and eventual cleanup. In my opinion, the responsibility rests entirely on W.R. Grace.

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FUTURE STUDIES

This report would certainly be lacking without a brief reference to future work. There were so many aspects to this report that it was difficult to decide how to tackle it. In the end I stuck to a technical lab report, but it also raised very interesting human, legal, and political issues. I am still waiting for a questionnaire I sent out to Ms. Fiore to come back, and I have pages of quotes from Arlington residents. Although I am not one to work on reports after they have been "finished", I would really like to keep working on this case and come up with some really striking conclusions to give to the MDEP, Conservation Law Foundation, or another institution.

Certainly the area should be tested for both the presence and the quantity of naphthalene, benzene, and acetone. How did Grace get the permission to develop in a wetlands area without an intensive EIR? Workers at One Alewife Plaza and local residents should be questioned about their feelings on W.R. Grace and how the area has changed over the years. Wells in the area could be sampled and

tested for toxic pollutants. Fish in the pond could be tested for bioaccumulation of naphthalene....the possibilities are limitless.

Finally, I would like to state that this project, haphazard as it may seem in this final form, has given me a real taste for environmental action and the possibilities for change. It was exciting and "real", and working in the chemistry lab was a highlight of the past few weeks. I really feel that this paper is only the project's first form, and that I can really take off and run with this. There **are** agencies and individuals out there who are interested in reversing the pollution trend! I look forward to finding out more about W.R. Grace in the coming months.

*I don't think
it bioaccumulates.*

Me too!

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