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SNELLIUS II EXPEDITION

RESULTS OF THE INVESTIGATIONS ON METALS, PHOSPHATE AND SILICATE

Snellius II Expedition. Theme V
Project I River inputs into ocean systems

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1. INTRODUCTION

As a part of the Snellius II Expedition Theme V "River Inputs into Ocean Systems", held in Indonesia from June 1984 to June 1985, the concentrations and behaviour of some major and trace elements were studied in the waters around the Island of Java. The investigation was carried out in the rivers Brantas and Solo, the Madura Straits, the Java Sea, the Strait of Bali, and in a part of the Indian Ocean. Elements determined were Cu, Zn, Pb, Cd, Ni, and Fe in the dissolved phase, and Cu, Zn, Ni, Cd, Pb, Cr, Fe, Mn, K, Ca, Mg, Al and Si in the suspended particulate matter.

To get an idea of the influence of the dry and wet seasons on these various water systems, sampling was carried out in July and August 1984 in the dry season, and in November and December 1984, at the start of the wet season. Each sampling period included a land-based part to sample the rivers and a part of Madura Strait, and a sea-based part to sample the Java Sea, Strait of Bali, and a part of the Indian Ocean.

The research vessel TYRO was used for the sea program. During the land-based period a catamaran took water samples from the rivers; the research vessel HATIGA from Puslitbang Pengairan Bandung and the AKABRI II of the Indonesian Navy collected water samples from the shallow part of Strait Madura. Surface samples were obtained from a rubber boat, while deep water samples were collected with Go Flo Sample bottles (General Oceanic). Mostly, only surface and bottom water samples were collected, but in the Indian Ocean some depth profiles were obtained at three stations. Originally, more Indian Ocean stations had been planned, but because of some technical problems and lack of time these stations had to be cancelled. The functioning of the (Go Flo) sampler was not always satisfactory, so there was not always enough information at all stations for a good interpretation of the data, but at least they give an idea about the actual metal concentrations in this part of the Indian Ocean.

A land-based station was set up for treating and analysing the samples. It consisted of ten laboratory containers with air conditioning, water and electricity supply. From this base, different sampling activities were coordinated:

a. Longitudinal surveys at the Porong and Solo rivers.
b. Anchor stations in the Porong and Solo rivers.
c. Sampling in the Strait of Madura with R.V. Hatiga and Akabri II
d. Sample transportation from the sampling site to the container station with cars and helicopters.

In the containers, sample treatment was started as soon as possible, mostly immediately after the samples were arrived. After processing, the samples were stored in cool containers for later analysis in the laboratory. All investigations were carried out in joint cooperation between Puslitbang Pengairan Bandung, LON Jakarta, and NIOZ Texel. A full description of all activities can be found in the field report "First Scientific Report of Activities Snellius II Expedition Theme V - Project I" and the Progress Report.

2. DESCRIPTION OF THE SAMPLING AREA

2.1. General Information

The Archipelago of Indonesia, lies along the equator, between the Pacific and the Indian Ocean, and between the mainland of Asia and the Australian continent.

The territorial land and water of Indonesia lie between 95^0 and 141^0 Longitude East and 6^0 North and 11^0 Latitude South. The longest distance from West to East is 5,120 km and from North to South 1,800 km. The land area of 1,920.000 km^2 consists of about 13,700 islands, among which about 6,000 are uninhabited. Geographically, the islands are grouped into four regions: 1. Kepulauan Sunda Besar, comprising Java, Sumatra, Kalimantan, and Sulawesi.
2. Kepulauan Nusa Tenggara, including the islands from Bali in the west to Timor in the east.
3. Kepulauan Maluku, consisting of all islands lying between Sulawesi and Irian Jaya.
4. Irian Jaya.

The climate of Indonesia is distinctly seasonal. The East Monsoon from June through September is controlled by dry continental air masses which come from the Australian desert, also called Dry Season. The West Monsoon from December through March is controlled by moisture-laden maritime air masses, the so-called Wet Season. The months of April-May and October-November are the transitional periods between the two seasons. The temperature tends to be uniformly high (26^0 - 28^{0}C) as an average with greater daily than seasonal variation.

The rainfall in Indonesia varies widely between 700 mm/year in rain shadow areas to 7,000 mm on the summits of some mountains; the average rainfall is 2,810 mm/year. Evapotranspriation is generally within the range of 1,000 mm/year to 1,500 mm/year. However, rainfall is not spread evenly over the various regions of the country. The high annual rainfall and the geological relief of the islands give existence to more than one thousand rivers. Stream-flow records tend to be rather incomplete, however, because gauging stations are not uniformly distributed, even on Java itself. This is principally caused , because most investigations have been carried out on an ad-hoc basis.

In addition to problems of total water availablity, caused predominantly by high population densities, the tropical monsoon climate causes imbalances in the distribution of the water availability throughout the year. Thus, the variations in the Wet Season and Dry Season permit an actual potential of water resources at only about 25 % of the maximum potential, except where artificial storage facilities have been constructed. For the densely populated main islands, such as Java, Madura, and Bali, a critical situation is already being faced. The total amount of water available in the hydrological cycle remains constant, whereas the population and development are growing rapidly. For Indonesia, the rate of annual population growth is about 2.34% and the rate of economic growth about

7.8%. It is therefore a major problem to maintain the availablity of water of acceptable quality.

Even though the total amount of water available is more or less the same due to the hydrological cycle, there are some efforts to increase the water potential, especially by improving the water quality, such as salinity control, pollution control, soil conservation and erosion control.

The activities mentioned above are called "Water Quality Control". As a part of water resources development, the total amount of potential water resources should be enlarged both quantitatively and qualitatively. Efforts which are being made to improve water quality include population control along the main rivers which pass big cities and large irrigation schemes, industrial and urban waste disposal control and continued and extended pollution control.

2.2. Water Quality research related in the Snellius II Expedition Program

Some of the Indonesian programs to improve water quality include continued monitoring of water pollution of main rivers and continued research on water quality control.

In the Snellius program the rivers Brantas, Porong and Solo were chosen because these rivers pass through several cities with a high possibility of water pollution and decreasing water quality. The river Brantas which divides by Mojokerto into the river Porong and river Surabaya, has its source close to Mahameru Mountain (3,676 m). There are a number of tributaries to this river, which passes the cities of Malang, Kediri, Jombang, Mojokerto and Surabaya (see Figure 1).

There are industrial areas and urban developments in the watershed of the Brantas, including the large industrial estate in Rungkut-Surabaya close to the river mouth. There are 4 artificial reservoirs, in the Brantas system viz. Selorejo, Kesamben, Wlingi and Selorejo. Those reservoirs have been developed to supply municipal drinking water, provide flood control, supply irrigation water, etc.

The river Solo flows from the Kukusan mountain (1,994 m) to Ujung Pangkah in the north area of Gresik. The river passes the cities of Wonogiri (where there is a big reservoir called Gajahmungkur reservoir), Surakarta, Ngawi, Bojonegoro, Babat and Gresik North (see Figure 1). The annual flood is uncontrolled in the area of Bojonegoro. As a consequence, Indonesian hydrological and environmental pollution studies are usually concentrated in that area.

3. SAMPLING PROCEDURES

3.1 On board the Tyro

Sampling aboard the Tyro was performed from 5-24 July 1984 dry season (first period), and 10-26 December 1984 wet season (wet period). Samples were collected in the Java Sea, Strait of Madura, Strait of Bali and the Indian Ocean (Figure 2 and 3). All surface samples were collected by means of a rubber boat, which was lowered from the Tyro and sailed more than 500 m away from the ship. Samples were collected in 1-liter pre-cleaned high-density polypropylene bottles, which were protected against contamination by wrapping them in plastic bags, and then putting them in a plastic drum. Seawater samples were taken by lowering the bottles into the water by hand (covered in plastic gloves) from the bow of the slowly moving rubber boat. The bottles were twice rinsed with sea water before the sample was taken. Immediately after sample collection, the bottles were sealed, wrapped again in the plastic bags and returned to the plastic drum, until processing could be carried out in the clean-laboratory container on board the ship. This container was equipped with two laminar-flow benches, a Milli-Q water purification system and a teflon pressure filtration system.

Water samples from the deep were obtained by means of Go-Flo Sampling bottles (30 l and 2.7 l) fitted in a Rosette frame together with a C-T-D probe system. Thus, salinity, temperature, and depth were registered continuously, and at the desired depth the Go-Flo samplers could be closed by an electronic signal. As soon as the Rosette frame was back on deck, one-liter samples were taken from each Go-Flo sampler, using the same procedure as described for the rubber boat. Smaller samples were taken to determine phosphate and silicate. Directly after collection, we filtered the samples under nitrogen pressure over a pre-cleaned and pre-weighed 0.45 Millipore filter (cellulose nitrate) fitted in a teflon filter apparatus. After filtering, the filters were rinsed with 50 ml double distilled water and stored in glass Petri dishes. Samples taken from the Indian Ocean were not filtered, because of the negligible amount of suspended particulate matter and in order to avoid the risk of contamination. Each filtered and unfiltered sample was acidified to pH 1-2, with 1 ml Suprapure HCl (conc) and stored for further treatment. Samples for phosphate and silicate determination were stored in a refrigerator and analysed within 10 hours after collection.

3.2. Land-based station

The land-based station activities lasted from 24 July to 22 August 1984 (dry period) and from 12 November to 5 December 1984 (wet period). The land-based station consisted of 10 laboratory containers installed in the harbour of Surabaya. Several ships were used in this period, including a fisheries prahu and a motor-driven catamaran for the rivers and shallow water work. R.V. Hatiga and Akabri II were used for the work in the Strait of Madura. During all trips an estuarine probe was used to collect data on salinity, temperature, pH, dissolved oxygen, turbidity and depth. To shorten the time between sampling and sample processing, the samples were transported every four hours from the river-based stations to the container station by car and helicopter. The helicopter picked up the samples from the Strait of Madura from a small speed boat, and transported them to a small airport close to the container station. At least twice a day this sample transport took place.

In the rivers some longitudinal sections were sampled, as well as 24-hour anchor stations. At these anchor stations, samples were collected every hour over complete tidal cycles. In the container the samples were treated in the same way as on board the Tyro. The only exceptions were the river samples with a high suspended load. Before filtering, these were shaken and an appropriate amount of water was taken to obtain enough material for analyses, mostly 200 ml. The rest of the sample was filtered in several portions over other filters to obtain enough water for the determination of the dissolved metals. It was aimed at to locate the anchor stations in such spots that during the sampling period a wide range of salinities could be sampled. Because of the daily variation in river run-off, the previous chosen spot was not always the best one. Thus, in the wet period only fresh water could be sampled in the river Porong.

4. ANALYTICAL METHODS

4.1 Dissolved Metals

The following procedure was used to extract 500 ml of the already filtered and acidified samples in a 1-liter teflon separatory funnel.

- 3 ml of a 2M ammonium acetate buffer solution is added to get a pH 4-5, check with a pH meter.
- Add 2 ml APDC/DDDC mixture solution and mix well (cleaned before by shaking three times with 20 ml MIBK).
- Add 20 ml MIBK and shake the solution 2 minutes.
- After phase separation discard the water.
- The remaining MIBK solution is rinsed with 10 ml bidistilled water to remove any remaining salt.
- After phase separation discard the water; only the MIBK solution should be saved.
- Add now 0.5 ml of concentrated HNO_3 (suprapur) to destroy the metal APDC complex. A reaction time of 20 minutes is needed.
- When the colour of the complex has disappeared, add 9.5 ml of very pure double-distilled water for back extraction.
- Shake the solution for 30 seconds.
  After phase separation the aqueous phase is collected in pre-cleaned teflon or polypropylene bottles and stored for later analysis.

Sample blanks are made by extracting 500 ml of double-distilled water to which 1 ml of suprapur HCl is added; this is to control the quality of the water and chemicals used. Standard calibration preparation: - Extracted water of a set of 6 samples is saved and collected in a clean bottle.

- Extract this water with an additional amount of MIBK to remove any residual trace elements.

- This cleaned water is partitioned over 6 separatory funnels. - One funnel is used as a blank and the others are spiked with various amounts of a mixed standard.
- The same extraction procedure as above for the samples is performed for the standard solutions, with exclusion of the buffer addition.
- A typical calibration line can be: 0, 1, 2, 4, 5, and 10 $\mu g l^{-1}$ for Fe, Cu, Ni, and Zn and 0, 0.1, 0.2, 0.4, 0.5 and 1.0 $\mu g l^{-1}$ for Cd and Pb.
- After extraction the metals can be determined by flame or graphite furnace A.A.S.

4.2 Metals in the suspended particulate fraction

The filters with the suspended particulate matter (SPM) are dried in an oven at 60-70°C and weighted. To determine the leachable and residual metal fraction in the SPM, the following procedures are used:
- The filter is destroyed in a low temperature asher. - The remaining SPM is leached with 50 ml of 0,1 N HCl for 18 hours.
- The solution is then filtered and this gives us the leachable metal fraction of the SPM.
- The filter with the residual fraction of the SPM is placed on the bottom of a teflon bomb with plastic pincers.
- 1 ml of aqua regia (mixture 3:1 of suprapur $HCl:HNO_3$), and 5 ml of suprapur HF are added to the bomb.
- The teflon bomb is closed and placed in an oven at 110°C for 2 hours.
- After cooling the content of the bomb is transfered to a 50 ml polypropylene volumetric flask containing 30 ml of a saturated Boric Acid solution.
- The teflon bomb is washed with a little double destilled water, which is added to the flask and then brought up to the mark
- The solution is well shaken; this gives us the residual metal fraction in the SPM.
- A blank is prepared in the same way with a clean filter.
- The leachable-plus the residual metal concentration gives us the total metal concentration in the suspended particulate matter.

4.3. Determination of Phosphorus

4.3.1. Special reagents

a. Ammonium Molybdate Solution Dissolve 15 gram of analytical reagent quality ammonium paramolybdete $(NH_4)_6Mo_7O_{24}.4H_2O$ (prefarably finely crystalline), in 500 ml of distilled water. Store in a plastic bottle out of direct sunlight. The solution is stable indefinitely.

b. Sulphuric Acid Solution
   Add 140 ml of concentrated analytical reagent quality sulphuric acid to 900 ml of distilled water, Allow the solution to cool and store it in a glass bottle.
c. Ascorbic Acid Solution
   Dissolve 27 grams of good quality ascorbic acid in 500 ml of distilled water. Store the solution in a plastic bottle frozen solid in a freezer.
   Than for use and refreeze at once. The solution is then stable for many months but should not be kept for more than a week at laboratory temperature.
d. Pottasium Antimonyl Tartrate Solution
   Dissolve 0,34 g of good quality potassium antimonyl tartrate (tartar emetic) in 250 ml of water. Warm if necessary. Store in a glass or plastic bottle. The solution is stable for many months.
e. Mixed Reagent
   Mix together 100 ml ammonium molybdate, 250 ml sulphuric acid, 100 ml ascorbic acid and 50 ml potassium antimonyl tratrate solutions. Prepare this reagent for use and discard any excess. Do not store for more than about 6 hours.
   The above quantity is suitable for about 50 samples.

4.3.2. <u>Analytical procedure</u>

a. Used the smaller volumes of 10 ml sample and 1 ml mixed reagent
b. Extinction is measured after at least 10 minutes and within 3 hours in a 5 cm cuvette (at wave length 8850 A)
c. Calibration is carried out by standard addition. The stock standard (10,000 uM) is diluted 40 times, the stock standard and the diluted standard are stored in a refrigerator, stock standard is stable for years, diluted standard is prepared every week. In a serie of determinations analyse two samples in duplicate and add also in duplicate, 200 µl of diluted standard to 9.8 ml of sample. This gives an increase in concentration of 5 uM and an increase in extinction of about 0.45. The factor F is therefore about 11.
d. Reagent tubes in which the determinations are carried out are stored in 1 N H_2SO_4. When the mixed reagent is no longer needed it is discarded and the flasks are thoroughly flushed with demineralized water.
e. Blanks with 10 ml demi or distilled water instead of the sample, should have extinctions below 0.003 in a 5 cm cuvette.

4.4. Determination of Silicate

4.4.1. Special Reagents

a. Molybdate Reagent
Dissolve 4.0 g of analytical reagent quality ammonium paramolybdate $(NH_4)_6Mo_7O_{24}.4H_2O$ (preferably fine crystalline) in about 300 ml of distilled water. Add 12.0 ml of concentrated hydrochloric acid (12 N), mix and increase the volume to 500 ml with distilled water. Store the solution in a polyethylene bottle, in which it is stable for many months provided it is kept out of direct sunlight. The reagent should be discarded if very much white precipitate is formed on the sides of the container. Metol-Sulphite Solution

b. Dissolve 6 g of anhydrous sodium sulphite Na_2SO_3 in 500 ml of distilled water and add 10 g of metol (p-methylaminophenol sulphate). When the metol has dissolved, filter the solution through a No. 1 Whatman filter paper and store it in a clean glass bottle which is tightly stoppered. This solution may deteriorate quite rapidly and erratically and should be prepared fresh at least every month. Oxalic Acid Solution.

c. Prepare a saturated oxalic acid solution by shaking 50 g of analytical reagent quality oxalic acid dihydrate $(COOH)_2.2H_2O$, with 500 ml of distilled water. Decant the solution from the crystals for use. This solution may be stored in a glass bottle and is stable indefinitely. Sulphuric Acid Solution 50% v/v.

d. Pour 250 ml of concentrated analytical reagent quality sulphuric acid into 250 ml of distilled water. Cool to room temperature and increase the volume to 500 ml with a little extra water. Reducing Reagent

e. Mix 100 ml of metol-sulphite solution with 60 ml of oxalic acid solution. Add slowly, with mixing 60 ml of the 50% sulphuric acid solution (above) and increase the mixture to a volume of 300 ml with distilled water. This solution should be prepared for immediate use and is stable for at least 1 month.

4.4.2. Analytical Procedure

a. Sample solutions should be at a temperature between 18 and 25^{0}C. Add 10 ml of molybdate soilution to a dry 50 ml measuring cylinder, stopper, mix the solutions and allow the mixture to stand for 10 minutes.

b. Add the reducing reagent rapidly, to make the volume exactly 50 ml and mix immediately.

c. The solution is allowed to stand for 2 to 3 hours to complete the reduction of the silicomolybdate complex. If precise values are required for amounts of silicon below about 12 µg/l use a 10 cm cell, otherwise measure the extinction of the solution in a 1 cm cell against distilled water. A wave length of 8100 A should be used with a spectrophotometer, if a filter type absorptiometer is used choose a filter having a maximum transmission above 7000 A.

Unless adjacent samples are known to have extinction values within about 25% of each other the absorptiometer cell should be rinsed before each new measurement.

d. Correct the measured extinction by subtracting a reagent blank obtained with a 1 cm or 10 cm cell as appropriate.

5. RESULTS

Because of the different sampling areas and periods, which have their own characteristics and concentrations, we have chosen to give a short description of each metal in the different parts of the investigated areas. Later we will discuss the results and compare the different areas with each other.

5.1 Dissolved Metals

5.1.1. Java Sea

The results of the dissolved metal analyses are presented in tables as well as in figures. The concentrations are expressed in $ng.kg^{-1}$ and in nM. In the figures both surface and bottom values are given, when available.

-COPPER (Cu), Fig. 4 and 4A.B.

Dissolved copper concentrations in the Java Sea are in the same range as already reported for other coastal waters, i.e. about 70-700 $ng.kg^{-1}$ (Boyle et al., 1981) with the highest values close to the coast of Surabaya. With the exception of three higher values in the wet period there is no large difference in the concentration range between the dry and wet period. Surface and bottom values are almost equal; however, the bottom values in the dry period tend to be somewhat higher than the surface values.

-B. NICKEL (Ni), Fig. 5 and 4A.B

Nickel concentrations fluctuated in the dry period 200-1600 $mg.kg^{-1}$, however, they fit well with values for other available areas (Boyle et al., 1981). In the wet period bottom and surface concentrations show very little variation around 300 $ng.kg^{-1}$.

-CADMIUM (Cd), Fig. 6 and 4A.B.

In the dry period the cadmium bottom concentrations were in the same range as in the surface water, 70-200 $ng.kg^{-1}$. In the wet period the concentrations were higher close to the Surabaya outlet than in the more eastern part of the sea.

-ZINC (Zn), Fig. 7 and 4A.B

With the exception of two higher zinc values of $\pm$ 1100 $ng.kg^{-1}$, the mean surface zinc concentration in the dry period, 500 $ng.kg^{-1}$, is very low compared to other coastal regions (Nolting 1986). Some high concentrations were also found in the wet period, but those were mostly situated close to the coast in shallow water. Bottom zinc concentrations are almost equal to the surface water concentrations.

-IRON (Fe), Fig. 8 and 4A.B
There is a large difference in the iron concentration between the dry and the wet period. In the dry period the mean iron concentration was about 500 $ng.kg^{-1}$, while the concentrations in the wet period fluctuate from very low 780 $ng.kg^{-1}$ to very high 62,000 $ng.kg^{-1}$.
-LEAD (Pb), Fig. 9 and 4A.B
The same situation as for iron with lower concentrations in the dry than in the wet period exists also for lead. The concentrations ranged from ± 100 $ng.kg^{-1}$ in the dry period to ± 600 $ng.kg^{-1}$ in the wet period. it should be noted, however, that in the wet period the sampling stations were situated closer to the coast.

5.1.2. Madura Strait

Figs 4-10 show the salinity and dissolved metal concentrations in the dry and wet period in Madura Strait. With exception of the stations close to the river mouths, salinity ranged from about 30 to 34 $^{0}/oo$ S in both periods. The lowest salinities are found near the mouth of the Porong river.
-COPPER (Cu), Fig. 4
Here we find a remarkable difference between the dry and wet period. In the dry period there was a distinct decrease in the dissolved cooper concentration from 1000 - 215 $ng.kg^{-1}$ in a seaward direction from Surabaya. This trend was also found in the wet period, although the mean concentrations were higher by a factor of 3 to 4.
-NICKEL (Ni), Fig. 5
For nickel the situation is the reverse of that of copper. In the dry period a large part of the Madura Strait showed very high nickel concentrations, clearly separated from the other parts of the Strait. Those concentrations ranged from 1700 - 5700 $ng.kg^{-1}$, while the other concentrations were more normal and around 400 $ng.kg^{-1}$. In the wet period the concentrations were lower ranging from 110-840 $ng.kg^{-1}$, with the highest concentrations near Surabaya.
-CADMIUM (Cd), Fig. 6
Cadmium shows little variation in the two periods. The tendency of the highest concentrations close to Surabaya is also observed for this element. Concentrations ranged from 17-281 $ng.kg^{-1}$.
-ZINC (Zn), Fig. 7
The concentrations were also higher in the wet period than in the dry, but the mean concentrations are lower than in the Dutch Wadden Sea, for instance. There are some high values in the dry period, but mostly below 1000 $ng.kg^{-1}$. Wet period concentrations ranged from 830-5500 $ng.kg^{-1}$.
-IRON (Fe), Fig. 8.
Iron was also higher in the wet period, as in the data from the Java Sea. Concentrations were almost ten times higher in the wet period than in the dry period. Thus, the mean concentration in the dry period is 3000 $ng.kg^{-1}$ and that in the wet period ± 30.000 $ng.kg^{-1}$.

-LEAD (Pb), Fig. 9
Also lead has the highest concentrations in the wet period. However the determination of lead is problematic because of the risk of contamination problems during sampling and processing. The concentration of lead ranges up to 3000 $ng.kg^{-1}$, but is very patchy.

5.1.3. River Solo

The sampling in the rivers Porong and Solo consisted of a longitudinal section and an anchor station. In most cases the anchor stations covered a 24 hour period in which samples were taken every hour. Samples from the longitudinal survey ranged from zero salinity (fresh water) to the highest salinity that could be obtained in the river mouth. In figs 11-18 the dissolved metal concentrations are plotted against station number and against salinity.
-COPPER (Cu), Figs 11-15
During the sampling period at the anchor station, the copper concentration was almost invariable. In both periods there was very little fluctuation with a mean concentration of 1400 $ng.kg^{-1}$. Data from the anchor stations show no relationship with salinity. This is supported by data from the longitudinal survey, where the copper concentrations are equal from salinity 0 to 30 ‰; and bottom and surface values do not differ.
-NICKEL (Ni), Figs 11-15
Nickel concentrations at the anchor station fluctuated the dry period from 250-500 $\mu g.kg^{-1}$. In the wet period there is a pronounced maximum of 1000-2000 $ng.kg^{-1}$, which shows no relation with salinity. It looks as if a water mass with a higher nickel concentration was travelling up and down the river. This higher concentration could not be found in the preceding longitudinal survey. Perhaps we observed an occasional phenomenon, caused by the mixing of bottom water with surface water through an increase in current velocity. This can be supported by data from the dry period where bottom water samples showed a twice higher nickel concentration than the mean surface water value.
-CADMIUM (Cd), Figs 11-15
The cadmium concentration at the second anchor station was almost constant at 25 $ng.kg^{-1}$, while the concentration in the dry period varied from 50 to 300 $ng.kg^{-1}$. This variation was also found in the preceding longitudinal survey.
-ZINC (Zn), Figs 11-15
The zinc concentration was constant around 1700 $ng.kg^{-1}$ during the first anchor station, while it fluctuated from 500 to 2000 $ng.kg^{-1}$ in the second anchor station. These fluctuations exist also in the data from the longitudinal survey, where values as high as 4000 $ng.kg^{-1}$ are found.
-IRON (Fe), Figs 11-15

As for the Java Sea and Madura Strait, the iron concentrations were much higher in the wet period. In the dry period the mean concentration was 2500 $ng.kg^{-1}$ increasing to 5000 $ng.kg^{-1}$ towards the end of the period. In the wet period the concentration varied from 10,000 to 20,000 $ng.kg^{-1}$. The data from the longitudinal survey also shows some higher concentrations in the wet period.
-LEAD (Pb), Figs 11-15
Lead had also higher concentrations in the wet period, and shows two maxima, around 1500 $ng.kg^{-1}$. In the dry period there was a constant value of 200 $ng.kg^{-1}$ which, like iron, increases at the end of the sampling period to 2000 $ng.kg^{-1}$. Data from the longitudinal survey indicate higher dissolved lead concentrations at higher salinities.

5.1.4. <u>River Porong</u>

Because of the very low water level in the wet period, it was impossible to make a longitudinal survey. However, one day before the anchor station started, heavy rainfall increased the water level dramatically, so that during the anchor station only fresh water could be sampled. The current was so strong that salt water intrusion was prevented even at high tide.
-COPPER (Cu), Figs 16-18
There is not much difference in the copper concentration between the two periods, but a somewhat larger variation in the wet period. There were two concentration levels in the dry period of 1800 and 2300 $ng.kg^{-1}$ respectively. Compared to the Solo, the mean concentration in the Porong is higher. Data from the longitudinal survey suggest a e.a. conservative mixing behaviour of dissolved copper.
-NICKEL (Ni), Figs 16-18
The first anchor station showed a period during which the nickel concentration increased to 1000 $ng.kg^{-1}$ from a mean value of 200 $ng.kg^{-1}$. Nickel concentrations in the wet period, 150 $ng.kg^{-1}$, were somewhat lower than in the dry period but there were also two high values. There is no correlation with salinity in the longitudinal survey data.
-CADMIUM (Cd), Figs 16-18
For Cadmium the concentrations were somewhat higher in the dry period (100 $ng.kg^{-1}$) than in the second (25-100 $ng.kg^{-1}$). In the wet period two concentration levels were present, one of 25 $ng.kg^{-1}$ and one of 100 $ng.kg^{-1}$. Some apparent removal of cadmium in the estuarine mixing zone can be observed.
-ZINC (zn), Figs 5, 16-18.
In contrast to nickel and cadmium, the lowest concentrations of zinc were found in the dry period (400-1500 $ng.kg^{-1}$). In the wet period the concentrations ranged from 1000 to 5000 $ng.kg^{-1}$. The data from the longitudinal survey tend to show a linear mixing behaviour when plotted against salinity.

-IRON (Fe), Figs 16-18
Iron concentrations were much higher in the wet period than in the first. While in the dry period the concentration was almost constant at 4000 $ng.kg^{-1}$, it ranged from 10,000 to 60,000 $ng.kg^{-1}$in the wet period. Data from the longitudinal survey agree with the data from the anchor station and show no removal effect.
-LEAD (Pb), Figs 16-18
Lead data are only available from the wet period and show a mean concentration of 1000 $ng.kg^{-1}$.

5.1.5. <u>Indian Ocean</u>

Because of technical problems and lack of time, we could only sample the two deep stations 21 and 20 in the dry period and 12 and 14 in the second. One shallow station close to Bali was also sampled (station no. 22 and 18). Figs 19-21 present the results. The data are not as complete as was hoped for because the Go-Flo samplers had sometimes problems with their closing mechanism. But, although not all profiles are optimal, they provide information about the different metal concentrations that exist in this part of the Indian Ocean. The samples were not filtered, but suspended matter will only slightly influence the actual concentration.
-COPPER (Cu), Fig. 19
The Copper concentrations in the surface water in both periods ranged from 0,5-2,5 $nmol.kg^{-1}$. However stations 14 and 20 give some dubious results. The deep water copper value seems to be 4-5 $nmol.kg^{-1}$.
-NICKEL (Ni), Fig. 20
Nickel showed a surface concentration of 3 to 4 $nmol.kg^{-1}$. There was a marked maximum in the nickel concentration at 1500 m and deeper at the stations 12 and 21. This maximum was 14-16 $nmol.kg^{-1}$ compared to 8 $nmol.kg^{-1}$ at 1000 m depth. The deeper station showed also this increase, in the dry period, but in the wet period the deep water concentrations were constant, near 7-8 $nmol.kg^{-1}$.
-CADIUM (Cd), Fig. 20
Cadmium showed the clearest profiles. The surface concentration was 0,2 $nmol.kg^{-1}$ in the dry period, and 0,02 $nmol.kg^{-1}$ in the wet period. The deep water values were almost constant at 0,6-0,8 $nmol.kg^{-1}$.
-ZINC (Zn), Fig. 19
Surface zinc concentrations scatter and were high, especially in the dry period. In the wet period there was an increase with depth to a concentration of 16-20 $nmol.kg^{-1}$.
-IRON (Fe), Fig. 21
The vertical distribution of iron in the dry period showed an increase in concentration down to about 1500 meter and then decreased to reach 10 $nmol.kg^{-1}$ at 5000 meter. Station 18 close to Bali showed a more scattered pattern. Stations 21 and 22 had no pronounced maximum, but the deep water concentration was equal to that in the dry period, with a value of around 10 $nmol.kg^{-1}$.

5.2. Metals in the Suspended Particulate Fraction

The metal content of the suspended particulate fraction can be presented both in $\mu g.g^{-1}$ and in %. In another way we can also present the metal concentrations in particulate form in $\mu g.kg^{-1}$ i.e. the contribution of the metal content of the suspended particulate matter to the total metal concentration i.e. the concentration in solution plus the concentration in the suspended matter. We present both data sets for the elements Cu, Ni, Cd, Cr and Pb.

5.2.1. Java Sea and Madura Strait to Pulau Kambing and Pulau Ketapang

Fig. 22 presents the concentration of suspended matter in the surface waters. In the dry period the suspended matter concentration ranged from 1.0-3.0 $mg.kg^{-1}$ in the waters around Java. In the wet period , with the sampling stations more close to the coast, suspended matter concentrations ranged from 0.6-8.2 $mg.kg^{-1}$. The concentrations in Strait Madura varied between 1.7 $mg.kg^{-1}$ in the more eastern part of the Strait to 60 $mg.kg^{-1}$ in the shallow part of the Surabaya to Solo area.

-COPPER (Cu), Figs 23-23A.

The concentrations of Cu, expressed in $\mu g.g^{-1}$, were higher in the dry period, 131-768 $\mu g.g^{-1}$, than in the second, 18-87 $\mu g.g^{-1}$. This is probably caused by the lower suspended matter concentration during the dry period. Concentrations in Madura Strait showed a range of 24-342 $ug.g^{-1}$, but with a mean value of about 100 $\mu g.g^{-1}$. Expressed in $ng.kg^{-1}$, the concentration ranged from 30 to 1000 $ng.kg^{-1}$ in the Java Sea, with the lowest values in the wet period. In agreement with the higher suspended load in the Madura Strait the amount of Cu, in $ng.kg^{-1}$, was also higher than that in the Java Sea and ranged from 50 to 3000 $ng.kg^{-1}$.

-NICKEL (Ni), Figs 23-23A

Nickel concentrations varied from 10 to 352 $\mu g.g^{-1}$ during both periods in the Java Sea, with one high value of 808 $\mu g.g^{-1}$ at station 23 in the wet period. In Madura Strait, the nickel concentrations were also very variable. The highest values were found in the dry period, up to 392 $\mu g.g^{-1}$. The nickel data from the Java Sea, in $ng.kg^{-1}$, were almost comparable with those of Cu, and higher in Strait Madura than in the Java Sea.

-CADMIUM (Cd), Figs 23-23A

In the Strait Madura the range was from 1 to 85 $ng.g^{-1}$ with in the dry period more higher values. The mean concentration of Cd, in $ng.kg^{-1}$, was about 150.

-LEAD (Pb), Figs 23-23A

In the dry period the lead values in the Java Sea were much lower and more constant than in the wet period. While in the dry period the concentrations varied between 128 to 489 $\mu g.g^{-1}$, they ranged from 107 to 2686 $\mu g.g^{-1}$ in the wet period. Data from the Strait Madura were more consistent and range from 12 to 351 $\mu g.g^{-1}$. These high variations are of course also found in the concentrations expressed as $ng.kg^{-1}$. While they vary in the Java Sea in the dry period between 190 and 1470 $ng.kg^{-1}$, they ranged from 80 to 15580 $ng.kg^{-1}$ in the wet period. The highest values of lead, expressed in $ng.kg^{-1}$, in Strait Madura were found in the waterway Surabaya to Solo up till 5500 $ng.kg^{-1}$, while in the eastern part of the strait the values were much lower and reached values as low as 210 $ng.kg^{-1}$.

-CHROMIUM (Cr), Figs 23-23a

Compared to the other metals, the chromium concentration in suspended matter is rather constant in the different regions. In the Java Sea it ranged from 18 to 227 $\mu g.g^{-1}$. In Madura Strait the mean concentration is 80 $\mu g.g^{-1}$, with the lowest concentrations occurring in the eastern part of the Strait. The concentrations, in $ng.kg^{-1}$, in the Java Sea were between 30 and 400 $ng.kg^{-1}$; the mean concentration is 200 $ng.kg^{-1}$. In Madura Strait these concentrations were higher in the Surabaya to Solo area, these are as high as 5000 $ng.kg^{-1}$ and decreased gradually in an eastern direction to 20 $ng.kg^{-1}$.

-ALUMINIUM (Al), Fig. 24

Aluminium is incorporated in the inorganic fraction of the suspended matter. This is clearly shown by the data from the different regions. The highest concentrations of aluminium, between 5 and 7.5%, were found in the Madura Strait with its high suspended load. They decrease in a seaward direction till not detectable.

-SILICIUM (Si), Fig. 24

The same holds for silicium. The highest concentrations occur in waters with a high suspended load, reaching 22%. They decrease to 2% in Madura Strait and were not detectable in many samples of the Java Sea.

-IRON (Fe), Fig.24

Iron behaves in the same way as aluminium and silicium. High concentrations occurred in the Surabaya to Solo region, with values between 3 to 5%, and much lower values down to 0,20% in the eastern part. Concentrations in the Java Sea samples are all below 1%.

-MAGNESIUM (Mg), Fig. 24

Magnesium ranged in all samples from 0.50 to 2.00 %, with a rather constant value of 1.20-1.30 % in the Surabaya-Solo region.

-CALCIUM (Ca), Fig.24

The calcium values are rather low in the whole region, with maximum values up to 1.40 %. Lowest values, $\pm$ 0,17%, were found in waters under influence of the river Porong, while those under influence of the river Solo are more than 1,00%.

-POTASSIUM (K), Fig. 24

In the Java Sea potassium values were all lower than 0,80%, with most values around 0.20%.In the Surabaya-Solo area the potassium values varied between 0.50 to 0.80%, while this is lower than 0.50% in the Porong area. Values in the wet period being lower than in the dry period.

5.2.2. River Solo

In that part of the river where the longitudinal survey showed a difference between surface and bottom salinity, surface and bottom samples were taken in the dry period. In the wet period only surface water was sampled.From the wet period anchor station some filters were used for x-ray diffraction to determine the mineralogical composition. suspended matter concentrations ranged at the first anchor station from 10 to 30 $mg.kg^{-1}$ and at the second from 10 to 22 $mg.kg^{-1}$. (See Fig. 27).

-COPPER (Cu), Figs 25-26

In both periods, the copper content in the suspended matter at the anchor stations ranged from 100 to 200 $\mu g.g^{-1}$. There was one higher value of 300 $\mu g.g^{-1}$ in the first period, but in this sample all other trace metals were also high. The small variation in copper content was also seen in the longitudinal surveys. Values in the wet period were again 100 to 200 $\mu g.g^{-1}$, while in the dry period they were somewhat lower, 20 to 150 $\mu g.g^{-1}$, with very little difference between bottom and surface samples. To compare the contribution of both the dissolved and particulate metal fractions the data are plotted together in fig. 27. No difference in their contribution to the total concentration is observed and they ranged both from 1000 to 2000 $ng.kg^{-1}$ in the dry period, with only small differences in the wet period .

-ZINC (Zn), Figs 25-26

Zinc concentrations varied at the two anchor stations from 250 to 500 $\mu g.g^{-1}$. This value was also found in the longitudinal surveys, but in the dry period it also showed an increase from the saline part of the river in upstream direction. The bottom zinc data reflected those in the surface layer, with a delay in time probably caused by higher salinity and coarser particles in the bottom layer. In contrast to copper the relative contribution of zinc in the particulate fraction was in both periods much more important than those in solution (Fig. 27).

-CADMIUM (Cd), Figs 25-26

Cadmium ranged at the two anchor stations from 10 to 20 $\mu g.g^{-1}$. During the first longitudinal survey the low cadmium concentration in the more saline part 5 $\mu g.g^{-1}$ increased gradually to 40 $\mu g.g^{-1}$ in upstream direction. Bottom concentrations behaved in the same way, but they were lower. During the second longitudinal survey this concentration was about 10 $\mu g.g^{-1}$. At the first anchor station the contributions of cadmium in solution and in the particulate fraction were almost the same, 100 to 300 $ng.kg^{-1}$ (Fig. 27). This is different in the wet period , when the concentration of cadmium in particulate form was 3 to 4 times that of cadmium in solution.

-NICKEL (Ni), Figs 25-26

Nickel values were around 100 $\mu g.g^{-1}$ at the anchor stations and during the wet period longitudinal survey. During this survey concentrations increased from 50 $\mu g.g^{-1}$ in the outer estuary to 100 $\mu g.g^{-1}$ in the fresh water area with very small differences between bottom and surface concentrations. The contribution of the nickel content in the particulate fraction to the total nickel concentration is superior to that in solution amounting in the dry period to 2000 $ng.kg^{-1}$ and 500 $ng.kg^{-1}$ respectively . However, in the wet period there were some high dissolved nickel concentrations, the amounts of nickel in suspension again being more important than those in solution, (Fig. 27).

-CHROMIUM (Cr), Figs 25-26

The concentrations of chromium were similar to those of nickel, 100 $\mu g.g^{-1}$ and showed the same behaviour. Concentrations were around 2000 $ng.kg^{-1}$ at the first anchor station, and varied between 1000 and 2500 $ng.kg^{-1}$ at the second.

-LEAD (Pb), Figs 25-26

At the anchor stations the mean lead concentration was about 150 $\mu g.g^{-1}$ with some higher values up to 400 $\mu g.g^{-1}$. As already noticed for zinc, cadmium and nickel, there was again an increase in lead concentration in suspended matter in an upstream direction, in this case from 50 to 300 $\mu g.g^{-1}$. This increase was also observed in the bottom lead concentrations. During the dry period the particulate fraction contributed the major part of lead to the total lead concentrations of 3000 $ng.kg^{-1}$ and 200 $ng.kg^{-1}$, respectively. The concentration of dissolved lead in the wet period was higher than in the dry period, but the concentration of lead in particulate form remained superior.

-SILICIUM (Si), Figs 28-29

The silicium content in the suspended particulate matter was between 10 and 20 % at both anchor stations. During the longitudial survey in the dry period somewhat lower values were reached. The bottom values followed those of the surface, but with a time difference caused by differences in salinity and mixing behaviour.

-ALUMINIUM (Al), Figs 28-29

During the wet period the aluminium content was higher than in the dry period, respectively 6-8 and 4-6%. Lower current velocity in the dry period and thus smaller particles in the water phase can cause this difference. Also a higher organic fraction in the fresh water during this period is a possible explanation. The aluminium contribution to the water phase was between 0,5 and 3 $mg.kg^{-1}$, (Fig. 27).

-IRON (Fe), Figs 28-29

Iron was also somewhat lower in the first than in the wet period, 2 to 4%, and 4 to 5% respectively. Compared to the amount of iron in the dissolved phase, that in particulate matter was much higher, reflecting the much higher amount of suspended matter (Fig. 27).

-CALCIUM (Ca), Figs 28-29

At the anchor stations the calcium content in the river Solo fluctuated between 1 and 2%. During the second longitudinal survey values were higher in the fresh water, 4%, and decreased gradually to 1% in saline water. Bottom and surface values were identical.

-MAGNESIUM (Mg), Figs 28-29
Magnesium had an almost constant value of 1%. Bottom and surface values were somewhat higher during the first longitudinal survey. At the first anchor station values between 0,05 to 0,1 mg.kg^{-1} were obtained.
-POTASSIUM (K), Figs 28-29
In the dry period concentrations of potassium were between 0,5 to 1%, and in the second 0,5%.
-MANGANESE (Mn), Figs 28-29
The manganese concentration was constant during the wet period anchor station and longitudinal survey, at a value of 1000 µg g^{-1}. During the dry period, however, it varied from 1000 to 3000 µg g^{-1}. Especially the behaviour of manganese in the first longitudinal survey is interesting. From a rather constant seaward value of 700 µg g^{-1}, it increased in an upstream direction, where salinity started to decrease, to 3000 µg g^{-1}. Bottom particulates followed the same pattern, but with an upstream shift caused by higher salinities (Fig. 29).

5.2.3. <u>River Porong</u>

-COPPER (Cu), Figs 30-31
The copper content at the anchor stations was different in the two periods. This was in fact not only the case for copper but also for the other trace elements. This is caused by the fact that higher river run off and current velocities were able to suspend coarser bottom material. Thus, finer particles with a relatively high trace metal content, were diluted by coarser bottom particles with a lower trace metal content. This effect resulted in a copper concentration in suspended matter almost 2 times higher in the first than in the wet period (200 and 100 µg.g^{-1} respectively). Data from the longitudinal survey in the dry period support this behaviour, the copper content in the river mouth being 100 µg.g^{-1}, and increasing in upstream direction to 200 µg.g^{-1}, (Fig. 31). In the dry period the ratio suspended: dissolved copper was 2 : 1, and in the wet period this was almost 20 : 1 (Fig 32). The amount of suspended matter in the wet period was 10 to 40 times higher than in the dry period.
-NICKEL (Ni), Fig. 30-31
In the first part of the first anchor station nickel was very stable, (50 µg.g^{-1}), but its concentration increased at the end of the sampling period to 200 µg.g^{-1}. At the second anchor station it was stable around 20 µg.g^{-1}. In the longitudinal survey concentrations were the same as those at the anchor station (about 50 µg.g^{-1}). During the dry period the ratio nickel in the suspended matter, dissolved nickel is 7 : 1, but in the wet period 50 : 1 (Fig 32). The causes for these differences are the same as for copper.
-CADMIUM (Cd), Figs 30-31

In the dry period the cadmium concentration fluctuated beween 10 and 60 $\mu g.g^{-1}$; in the wet period it was stable around 2 $\mu g\ g^{-1}$. The fluctuation in the dry period, is obviously caused by mixing of marine and fluviatile materials. This conclusion is in agreement with data from the profile of the longitudinal survey. This profile exhibits a very low cadmium concentration of 5 $\mu g.g^{-1}$ seaward and a gradual increase to 50 $\mu g.g^{-1}$ in upstream direction. Because of the very low cadmium concentration in the suspended matter of the wet period, the relative contribution of cadmium in suspension to total cadmium is small in both periods (Fig 32).

-ZINC (Zn), Figs 30-31

Zinc shows almost the same pattern as cadmium, its concentration fluctuating in the dry period, and being stable but lower in the wet period. The relative contribution to the total amount of zinc in the water phase was in the wet period almost 8 times higher than in the dry period. (Fig. 32).

-LEAD (Pb), Figs 30-31

The picture of lead shows a low concentration of 100 $\mu g.g^{-1}$ in the beginning of the first anchor station, increasing at the end to 300 $ug.g^{-1}$. Concentrations at the second anchor station were 5 to 15 times lower than in the dry period. Again, this is due to differences in suspended matter concentration. In the wet period, the relative contribution of lead in the suspended matter to the total lead concentration is 60 times higher than those in the dissolved phase (Fig. 32).

-CHROMIUM (Cr), Fig. 30-31

Chromium concentrations during the anchor stations were, in the dry period 40-120 $\mu g.g^{-1}$ and in the second 20 $\mu g.g^{-1}$.

-SILICIUM (Si), Figs 33-34

Silicium was constant during the whole anchor station in the dry period and longitudinal survey at 15%. In the wet period this percentage was somewhat higher, except for one value showing a rather low Si concentration. This was also the case for Al, Fe and Mn, but cannot be explained by a change in the suspended matter concentration (Fig. 35).

-ALUMINIUM (Al), Figs 33-34

For aluminium we have the same situation as for silicium with a value, however, between 6 and 7%.

-IRON (Fe), Figs 33-34

In the dry period the iron concentration was somewhat lower than in the wet period (4 to 5,5%). Its contribution to the total concentration of iron in the water phase is, however, 20 times larger in the second than in dry period. (Fig. 32).

-CALCIUM (Ca), Figs 33-34

In the dry period the calcium concentration in suspended matter was 0,2-0,3% and in the second 0,5%.

-MAGNESIUM (Mg), Figs 33-34

Concentrations of magnesium fluctuated slightly between 0,5 and 1%.

-POTASSIUM (K), Figs 33-34
Potassium concentrations were in the dry period around 0,5% but decreased in the wet period to 0,2%.
-MANGANESE (Mn), Figs 33-34
The manganese concentration in suspended matter behaved in the two periods in a same way, just as in the river Solo. At the second anchor station its concentration was around 1000 $\mu g.g^{-1}$, but at the first 2000-3000 $\mu g.g^{-1}$ comparable to the changes in the Solo River. Also its behaviour in the longitudinal survey was the same as in the Solo river: from a concentration of 1500 $\mu g.g^{-1}$ it increased gradually to 3000 $\mu g.g^{-1}$ in upstream direction.
The total contributions of Al, Cr, Ca, Mg, K and Mn to the water phase are summarized in Fig. 35.

5.3. Slicate and Phosphate.

The surface values of silicate and phosphate in the Java Sea and Madura Strait are plotted in Fig.36. Phosphate is only determined in the dry period. Surface phosphate concentrations vary from 0,04 to 0,33 $\mu mol\ kg^{-1}$. These values are in good agreement with data published by Boyle et al., (1981), for coastal waters of the Pacific and Atlantic Ocean. Two high values were observed at stations 14 and 18, respectively. At these stations, also high surface iron and zinc values were observed. In Fig. 37 surface and bottom concentrations are plotted against station numbers. It is evident that the highest bottom concentrations were found near the Surabaya outlet and west of this outlet. Values for Madura Strait are highest in the track from Surabaya to Solo. This area is under the influence of wastes from Surabaya and a fertilizer factory in Gresik.

Concentrations in the eastern part of Strait Madura were higher than in the Java Sea and decreased in seaward direction. Concentrations are moderately high, 4 to 5 $\mu mol\ kg^{-1}$ in the Porong but much lower 1,15 to 1,6 $\mu mol.kg^{-1}$ (anchor station) in the Solo river (Fig. 38). The distribution of phosphate is heavily influenced by anthropogenic effects. Concentrations in sparsely populated tropical areas are about 0,2 $\mu mol\ kg^{-1}$, whereas concentrations in densely populated industrialized areas may be up to 50 $\mu mol.kg^{-1}$ (Bennekom & Salomons, 1981). Estuarine mixing is not conservative, at intermediate salinities, concentrations are higher than expected from linear interpolation. Phosphate discharges are in the form of organically bound phosphorus and mineralization takes some time.

Surface silicate values in the Java Sea ranged from 2 to 7,5, $\mu mol.kg^{-1}$ in the dry period, with higher concentrations close to the coast. This are reasonable values for coastal waters, (Boyle et al., 1981). In the wet period silicate concentrations were higher in the near coastal area and decreased in more seaward direction. Bottom and surface values are presented in Fig.37. The bottom concentrations over the entire region were higher than the surface concentrations. Concentrations in the Madura Strait did not differ very much in the two periods. The values were higher than in the Java Sea, as a result of the influence of the rivers with their very high silicate concentrations. Because of higher river run-off in the wet period, we observed this influence further from the river mouth than in the dry period.

Concentrations in the rivers were about 410 µmol kg^{-1} in the Solo and 680 - 780 µmol kg^{-1} in the Porong. These are indeed high values, the discharge weighted world average of silicic acid in river water being about 175 µmol kg^{-1} (Meybeck, 1981). Large variations occur due to interaction of rain water with soil, (Young, 1976) and high silicium concentrations occur in soils with volcanic debris. These can be easily weathered, which explains the high concentrations in the Solo and Porong. Even higher values were found in rivers in West Java (van Bennekom, personal communication). During mixing with sea water deviations from conservative mixing were minor; however, there is some scatter in the low salinity region (Fig.39), which may be caused by variations in the river concentration or by short term salinity variations during sampling: preferably salinity and silicic acid concentration should be measured in the same bottle, which was not the case. There are no indications of "inorganic precipitation" of silicic acid during estuarine mixing, a process to occur in rivers with high silicic acid concentrations,more than 230 nmol.kg^{-1} (Liss, 1976) but never clearly demonstrated (Liss, 1976).

6. DISCUSSION

6.1. Dissolved Metals

6.1.1. Regional Distribution

Figure 40 shows the mean dissolved surface concentrations of Cu, Fe, Cd, and Pb in the different regions, in the two sampling periods, and their range. These data are summarized in Table I.

The sampling area is divided into 14 specific regions called:

A. Longitudinal survey Porong river

B. Anchor station Porong river

C. Fresh water end member Porong

D. Longitudinal survey Solo river

E. Anchor station Solo river

F. Surabaya to Solo track

G. Wonokromo river estuary

H. Madura strait Track I

I. Madura strait Track II

J. Madura strait Track III

K. Madura strait with R.V. Tyro

L. Java Sea

M. Water around Bali

N. Indian Ocean

The concentrations of Cu (Fig. 40), with exception of those in the Madura Strait, were almost equal in the two periods and ranged from ± 3000 $ng.kg^{-1}$ in the Porong river to ± 100 $ng.kg^{-1}$ in the Indian Ocean. In the Madura Strait the mean concentration was about 400 $ng.kg^{-1}$ in the dry period, but ± 1600 $ng.kg^{-1}$ in the second. This increase in concentration is difficult to explain because the concentrations in the river and salinity did not change during the two sampling periods. Maybe biological or antropogenic influences were responsible. There is a distinct difference in the copper concentration in the two rivers, which is almost 1000 $ng.kg^{-1}$ higher in the Porong than in the Solo. The overall view gives a picture of higher Cu concentrations in the rivers, which decreased in seaward direction by dilution by sea water with a lower copper content. Consequently the concentrations were high in Madura Strait, lower in the Java Sea and Bali waters and the lowest concentration was found in the Indian Ocean.

For Ni (Fig.40) the data were characterized by higher nickel concentrations in part of the Madura Strait in the dry period. Those higher concentrations were also observed in the preceding sampling programme with R.V. Tyro in the same area two weeks earlier. In general the concentrations were higher in the dry period than in the second. Nickel concentrations were higher in the Solo than in the Porong by at least a factor of two. However, except the high concentrations in the Madura Strait, concentration differences in the different regions are small, and vary between 200 and 400 $ng.kg^{-1}$. It is possible that the region of high nickel concentration in the Strait is caused by oil, which spread out over a large area as a thin film, but this could not be confirmed.

The variation in the Cadmium concentration (Fig. 40) is much larger in the first than in the wet period. This is true for almost all regions. There is some evidence that the concentration in the Porong river is higher than in the Solo. Also for Cadmium there is little difference in the mean concentration level of the different regions, which in the dry period was from 90 to 200 $ng.kg^{-1}$, and in the wet period 20 to 80 $ng.kg^{-1}$. Only in the Indian Ocean the concentration of Cd is lower than in the other regions (4 and 25 ng.kg^{-1}).

For lead (Fig. 40) the concentration is higher in the second than in the dry period. The general trend is lower concentrations in the Porong and Solo river, an increase in the Madura Strait region and than a decrease toward the Java Sea and the waters around Bali. Lowest concentrations were again found in the Indian Ocean (60 - 100 ng.kg^{-1}). The mean concentrations were 900 ng.kg^{-1} in the rivers and 1500 ng.kg^{-1} in the Madura Strait.

Zinc concentrations in the rivers were in the wet period higher than in the dry period (Fig. 40). This has its influence on the concentrations in the different parts of the Madura Strait. While in the dry period the dissolved zinc concentration is almost the same in the rivers and Madura Strait (around 1000 ng.kg^{-1}), and 300 ng.kg^{-1} in the Java Sea and eastern Madura Strait, there was a more gradual decrease in the zinc concentrations in the wet period. Here the mean concentrations were 2500 ng.kg^{-i} in the rivers, decreasing to 1500 ng.kg^{-1} in the Madura Strait. In the Java Sea it was around 800 ng.kg^{-1} while the lowest concentrations were found in the waters around Bali and the Indian Ocean 450 ng.kg^{-1}.

For Iron the situation is very complicated because of the large difference in concentration between the first and wet period. In the dry period there was a decrease in concentration from the rivers (4000 ng.kg^{-1}) through the Strait of Madura (1800-4000 ng.kg^{-1}) to the Java sea (550 ng.kg^{-1}). Concentrations were somewhat higher in the Indian ocean (1600 ng.kg^{-1}), but these were measured in unfiltered samples. Over the entire region, the concentrations were drastically higher in the wet period. However, the concentrations reached values as high as 40000 ng.kg^{-1} in the rivers, which is not unusual for river water. The low concentrations in the dry period were more exceptional, because the world iron content in river waters is calculated to be 40 μg.kg^{-1} (Meybeck, 1978). In some other rivers dissolved iron concentrations are even as high as 700 μg.kg^{-1} (Figueres et al., 1978).

The difference in iron concentrations in the two periods can possibly be explained by the low current velocity and discharge of the rivers in the dry period. A long residence time of the water gives the colloidal iron fraction the time to be removed from the water phase by coagulation and adsorption on particulates (Figueres et al., 1978; Edzwald, 1972: Sholkovitz, 1976).

6.1.2. Comparison with other Data

Cu: As noted earlier by Meybeck (1978) and Moore and Burton (1978), limited dissolved trace metal data are available from rivers in tropical regions. For copper, the estimated average global river water concentration is 7 μg.l^{-1}. These authors suggest that this concentration will be much lower when values for tropical rivers can be included. Low dissolved copper concentrations are now found in the

Zaire (0.3 µg.l^{-1}), Moore and Burton (1978) and Amazone (1.8 µg l^{-1}, Gibbs, (1977), which support the low concentration we determined in the Solo (2000 ng.kg^{-1}) and Porong (3000 ng.kg^{-1}). On the other hand are these concentrations comparable with low polluted European rivers like the Ems and Weser (Duinker et al., 1982, 1985) and the Göta river in Sweden (Danielson et al., 1983) but lower than the Rhine and Elbe (Duinker et al., 1978,1982).

The mean coastal copper concentrations of 250 ng.kg^{-1} found in eastern Indonesia are equal or lower to those published from other coastal areas (Nolting, 1986; Kremling, 1985; Duinker and Nolting, 1982; Kremling and Petersen, 1984; Danielson and Westerlund, 1984; Bruland et al., 1985).

Ni: Very few dissolved nickel data from rivers are available, but comparison of the data from the Solo 600 ng.kg^{-1} and Porong 350 ng.kg^{-1} with known data indicate that these concentrations are rather low. The nickel concentration is for instance in the St. Lawrence 1.5 µg.l^{-1} (Yeats and Bewers, 1982) in the Gõta river 0.7-0.9 µg.l^{-1} (Danielson et al., 1983) while Nolting (1986) reported values as high as 3000 ng.kg^{-1} in the river Rhine.

The mean coastal nickel concentration is with exclusion of the exceptional high nickel concentrations in the dry period 300 ng.kg^{-1}. This value is equal to that in other ocean shelf waters (Bruland and Franks, 1983; Kremling, 1985). Compared to European coastal areas, the values reported here are equal (Nolting, 1986; Kremling, 1985) or even much lower (Kremling and Petersen, 1984; Danielson and Westerlund, 1984).

Cd: The dissolved cadmium concentration in the two rivers is different in the two sampling periods, around 200 ng.kg^{-1} in the first and 50 ng.kg^{-1} in the wet period. These values are almost in the same order of magnitude as those from some European rivers c.q. the Elbe, Weser and Ems in which concentrations ranged from 100 to 600 ng.kg^{-1} (Duinker et al., 1982, 1984, 1985). Recently Nolting (1986) determined the dissolved cadmium concentration in the Rhine to be 200 ng.kg^{-1}. Compared to these data those in the Göta river 9-25 ng.kg^{-1} (Danielsson et al., 1983) and in the Amazone 6-8 ng.kg^{-1} (Boyle et al., 1982) are rather low.

Reported coastal cadmium concentrations range from 11 to 50 ng.kg^{-1} (Balls, 1985; Nolting, 1986; Kremling, 1985; Kremling and Petersen, 1984; Bruland et al., 1985; Danielsson and Westerlund, 1984). Thus the present data from the waters around Java, 50-120 ng.kg^{-1}, suggest somewhat higher coastal cadmium concentrations.

Zn: Few reliable zinc data in tropical rivers are available. Duinker and Nolting (1978) reported zinc values of 60-80 µg.kg^{-1} in the Rhine. Recently Nolting (1986) determined in the same river a dissolved zinc concentration of 20 µg.kg^{-1}. Zinc concentrations in the Elbe and Weser varied between 5 to 10 µg.kg^{-1} (Duinker et al., 1982). In some other European rivers zinc concentrations were somewhat lower 5-7 µg.kg^{-1} (Duinker et al., 1985; Danielsson et al., 1983). So the zinc concentrations in the Solo and Porong which ranged from 900 to 2700 ng.kg^{-1} are rather low.

The range of the dissolved zinc concentration (260-1500 $ng.kg^{-1}$) in the the waters around Java is very reasonable. In the Baltic area zinc concentration range from 900-1800 $ng.kg^{-1}$ (Kremling and Petersen, 1984), Danielsson and Westerlund (1984) reported 900 ± 160 $ng.kg^{-1}$ in the same area. In Dutch coastal waters this concentration under influence of the river Rhine is 5 $\mu g.kg^{-1}$ (Nolting, 1986).

Fe: As showed by Figueres et al., (1978) for the Zaire river, the determination of the real dissolved iron concentration in river waters is very difficult. They showed that the dissolved iron concentration decreased by using filters with a decreasing pore size. Thus, these authors found in the same sample a dissolved iron concentration of 415 $\mu g\ kg^{-1}$, if they use filters with a pore size of 3 µm and 101 $\mu g.kg^{-1}$ by filters with a pore size of 0.025 µm. However, we used filters with a pore size of 0.45 µm, our dissolved iron concentrations varies remarkedly in the two periods. The mean concentration is 4 $\mu g.kg^{-1}$ in both rivers in the dry period. In the wet period this is 33 $\mu g.kg^{-1}$ for the Porong and 10 $\mu g\ kg^{-1}$ for the Solo. These values are not unrealistic compared to those in the Amazone river 34 $\mu g.kg^{-1}$ (Gibbs, 1977). These concentrations are also comparable with those in some European rivers. Elbe, Weser and Ems (Duinker et al., 1982, 1982, 1985). Rhine (Duinker and Nolting) and in the Göta river, (Danielsson et al., 1983).

Coastal iron concentrations 83-130 $ng.kg^{-1}$ are comparable to those in the Mediterranean Sea (Laumont et al., 1984). On the other hand, those concentrations are 3 to 5 times higher than those reported from the coastal area of the Atlantic near St. Nazaire, France (Bewers et al., 1985).

6.1.3. Estuarine behaviour

Many processes play a role in determining metal distributions and concentrations in the estuarine mixing zone. The interaction of suspended particulate matter with waters of a different salinity can influence the distribution over the dissolved and particulate forms. Some elements show a conservative behaviour, others are subjected to removal or mobilization processes (Duinker, 1980; Duinker and Nolting, 1978).

To study these processes in the Solo and Porong rivers, anchor stations and longitudinal surveys were carried out in the estuarine zone. Dissolved metal concentrations plotted against salinity are presented in Figures 13, 14, 15 en 18.

Cu: Concentrations of copper during the three different surveys showed a decrease in seaward direction which mostly started at 10 ‰ S, and a fast drop at 25 ‰ S. Data from the Solo river suggest a conservative behaviour during mixing of bottom and surface waters. This is in agreement with the observations of Danielsson et al., (1983) in the Göta river, but different from those in the Rhine and Elbe rivers (Duinker and Nolting, 1978; Duinker et. al., 1982) where removal of Cu from the water phase was observed.

Ni: During the longitudinal survey in the Solo in the dry period nickel showed an increase in the dissolved concentration at the bottom starting from 10‰ S in a seaward direction (fig. 13).
Bottomwater with a higher nickel concentration mixed with the overlaying water and thus increased the surface water concentration. An explanation for the higher bottom concentration can be desorption from particulate matter or mobilization from partly reduced sediments as is also suggested to occur for continental slope waters (Kremling, 1985; Jones and Murray, 1984).

Cd: Cadmium showed in the Porong removal from the water phase, but in the Solo the concentration is almost constant over the whole salinity regime with equal bottom and surface concentrations. This constant concentration was also reported by Danielsson et al., 1983. They suggest desorption from particles or an extra (industrial) input. The last suggestion can not hold for the Solo since there are no industries here. The input might come, however, from outside the estuary. In the Rhine estuary removal of Cd is observed (Duinker and Nolting, 1978) but in the Weser and Ems its behaviour is the same as in the Solo (Duinker et al., 1982).

Zn: Zinc concentrations decrease in seaward direction but the variation of the zinc concentration in the fresh water region is very large, so it is very difficult to draw conclusions about its behaviour. However, conservative behaviour seems quite acceptable. Unfortunately no bottom values are available. The zinc concentrations, as already noted earlier, are rather low for river waters. As will be discussed later, the rivers contain a relatively high amount of organic material, so that an exchange with organic material might be responsible for the large variation in the zinc concentration.

Fe: Iron showed a complex picture. While in most rivers iron is removed from solution by adsorption on particles and subsequent precipitation, (Duinker and Nolting, 1978; Figueres et al., 1978; Sholkovitz, 1976) this behaviour is not evident in the rivers studied in this paper. It is evident that bottom sediments must play a role in determining the concentration of dissolved iron. The high bottom concentration of dissolved iron supports this assumptions. Sugimura et al., (1978) showed that, during estuarine mixing, dissolved organic iron was not affected by removal processes. A a high concentration of organically bound iron might explain the rather unusual iron behaviour.

Pb: Mobilization of lead from river borne particulates can explain the higher lead concentration at higher salinities. However, transportation of lead in particulate form originating from can exhausts carried in the air and precipitated by rain in sea water may obscure the data.

Because of almost the same behaviour of the metals at the anchor stations as during the longitudinal surveys, the latter are not further duscussed here.

6.1.4. Vertical profiles in the Indian Ocean

Cd, Si and P. Vertical profiles of Cd are presented in Fig. 20, those of phosphate and silicate in Fig. 41. The profiles show the same characteristics as reported by previous investigators (Bruland, 1980; Bruland and Franks, 1984; Yeats and Campbell, 1983; Danielsson et al., 1985) for Pacific and Atlantic Ocean waters. Cd is depleted by biological processes in the surface waters and the concentrations increase with depth to a maximum of about 0.7-0.8 $nmol.kg^{-1}$. This concentration is almost constant below 1.000 m. Surface concentrations in the dry period $\pm$ 0.24 $nmol.kg^{-1}$ were higher than in the second (0.03 $nmol.kg^{-1}$). These higher surface concentrations can be due to a low biological activity in one season (dry monsoon), because very high phosphate values (10 $nmol.kg^{-1}$) are simultaneously found at these stations. Phosphate concentrations decrease very fast to 0.12 $nmol.kg^{-1}$ at 25 m depth. All these samples were unfiltered. If the surface samples were filtered over 0.45 um Millipore filters, the phosphate concentrations decreased to 0.13 $nmol.kg^{-1}$. Therefore, decomposition of dead particulate organic material can be responsible for the high cadmium and phosphate values in the nearsurface layer.

Deep water cadmium and phosphate concentrations were lower than those found in the North Pacific, 0.94 $nmol.kg^{-1}$ and 2.75 $nmol.kg^{-1}$ respectively (Bruland, 1980), but higher than in the North Atlantic. In Fig. 42 the cadmium concentration is plotted against phosphate. The same relation was earlier published by Bruland (1980) for the Pacific and by Yeats and Campbell (1983) and Danielsson et al., (1985) for the North West Atlantic and North East Atlantic respectively. The respective equations these authors found are $Cd=0.347\ PO_4-0.068$. $Cd=0.28\ PO_4+0.01$ and $Cd=0.19\ PO_4+0.001$. Danielsson (1979) reported for the Indian Ocean $Cd=0.23\ PO_4+0.11$. We calculated here with exclusion of the high surface data $Cd=0.21\ PO_4+0.07$. n=24. This value is comparable with that of Danielsson et al., (1985) in North East Atlantic waters and the Indian Ocean. but lower than in the Pacific and North West Atlantic waters. Unfortunately no phosphate data from the wet period are available so that no equation can be established for this period.

Ni: Vertical profiles of Ni are plotted in Fig. 20. Surface concentrations were between 2 and 4 $nmol.kg^{-1}$ with a rapid increase at 50 m for stations 12, 20, 21 and 22 to 6-8 $nmol.kg^{-1}$. Bruland (1983) reported surface nickel concentrations in the oceans from 2.1-3.7 $nmol.kg^{-1}$.

Stations 12, 21 and 22 show a sharp increase below 1000 m with concentrations as high as 16-18 $nmol.kg^{-1}$. These last results are similar to those reported by Jones and Murray (1984) in North East Pacific continental slope water. They explained these higher Ni concentrations through mobilization of Ni from hemipelagic sediment.

Station 20 does not show this sharp increase along the vertical in concentration but has an almost constant value of 7-8 $nmol.kg^{-1}$. It is interesting to note that this last profile is comparable with those in the Atalantic Ocean; however, the concentration is a factor of 2 larger than in the Pacific where a more gradual increase of nickel occurs (Yeats and Campbell, 1983; Danielsson et. al, 1985; Bruland and

Franks, 1983). Nickel concentrations in the deep water profile are intermediate between values reported for the North Atlantic (4.3 $nmol.kg^{-1}$) and the Pacific Ocean (10.9 $nmol.kg^{-1}$).

Values from station 14 are more scattered; however, there is also evidence of an increase in concentration below 1000m with a subsequent decrease to lower values below 3000m.

Zn: The vertical profiles of Zn are plotted in Fig. 19. Surface concentrations at stations 12, 14 and 18 were 8.0, 21.6 and 21.7 $nmol.kg^{-1}$ respectively. These are much higher than the values reported by Bruland (1980) for the North Pacific, where he observed a depletion in the surface waters to concentrations less than 0.1 $nmol.kg^{-1}$. This author also reported a relationship between zinc and silicate. Fig. 42 also shows such a relationship. However, zinc concentrations in the upper 200m of the stations 12, 14 and 18 are higher and do not fit in this relation. Either there is an external source, supporting the high surface zinc concentrations or the biological uptake is less efficient in the period of observation.

Calculated from the data from Fig. 42 our expression for the relation between zinc and silicate is Zn=0.145 Si+2.18. Bruland (1980) fou nd $Zn=(0.0535+0.0008)\ Si+(0.02\pm0.09)$ in the Pacific, and Yeats and Campbell (1983) $Zn=(0.17\pm0.03)\ Si+(2.3\pm0.4)$ in the North West Atlantic. The last equation is comparable with our expression.

The deep water maximum for Zn was around 20 $nmol.kg^{-1}$; station 20, however, showed a decrease and station 14 an increase in concentration at the deepest points. Compared to other areas, the deep water concentration is about 2 times higher than in the North Pacific and 4-10 times higher than reported for the Atlantic (Bruland and Franks, 1983; Yeats and Cambell, 1983; Danielsson et. al., 1985).

Cu: Vertical profiles of Cu are presented in Fig. 19. With the exception of station 12 the dissolved Cu profiles show a rather confusing pattern, maybe caused by contamination. Surface copper concentrations were between 0.5 and 3 $nmol.kg^{-1}$. These values are in good agreement with those reported by Boyle et al., (1981) for North Atlantic and North Pacific waters, and recently by Kremling (1985) for the Atlantic Ocean.

With the exclusion of higher values of station 14 at 1500 and 2500 m, the deep water Cu concentration increased to 4 $nmol.kg^{-1}$. These are comparable to deep Pacific water but they are two times higher than in deep Atlantic waters (Bruland and Franks, 1980).

Fe: Iron profiles are plotted in Fig. 21. Surface iron concentrations were relatively high, perhaps as a result of particulates in the unfiltered samples. Stations 12 and 14 show an increase of Fe with depth and a subsequent decrease below 1500 m to a constant value of $\pm$ 10 $nmol.kg^{-1}$. The peak in the iron profile can be caused by particulate iron and plankton, while at greater depths an equilibrium between dissolved and particulate iron can occur. Danielsson et al., (1985) reported iron concentrations in deep North Atlantic waters of about 4 $nmol.kg^{-1}$.

6.2. Metals in suspended Particulate Matter

6.2.1. Distribution patterns

As earlier reported (Duinker et al., 1980, 1982a, 1982b) there is a difference in the behaviour of the elements Cu, Zn, Cd, Pb, Cr and Ni and those of Si, Al, Ca, Fe, Mn, Mg and K. At a lower amount of seston par liter the concentrations of the first group of elements in the suspended matter increase, and those of the second group decrease. This is mainly due to a particle size effect and also to a different distribution of the two groups of elements over the organic and inorganic fractions of the suspended matter (Duinker, 1981; Duinker et. al, 1980, 1982a, 1982b; Duinker and Nolting, 1976). This pattern is roughly also present in our observations; however it is not evident for the first group of elements: only samples with a suspended load lower than 2 $mg.kg^{-1}$ show the effect clearly, Cu, Pb and Cd being the best evident examples. For the other elements the distribution is more equal, possibly due to the influence of coarser particles with a relative high Ni and Cr concentration on one hand and more living plankton on the other (Fig. 23).

Contrary to this behaviour is that of the second group of elements. From this group, Si, Al and Fe show a decrease in concentration in suspended matter in seaward direction. This decrease happens very fast, indicating a sharp boundary between particles transported downstream by the rivers and particles in the Java sea and the Strait Madura. The main reason for the behaviour shown is the difference in the inorganic and organic fraction of the suspended matter which in the rivers consist mainly of aluminium silicates and quartz, while the in the Java sea and Strait of Madura it consists mainly of organic material. Also the almost constant values of element/Al ratio in the rivers, increase drastically in seaward direction indicating a change in particulate matter (Table X). This fact is in contrast to waters of the southern Bight of the North Sea where living phytoplankton plays a relatively unimportant role in the total metal concentration in suspended matter (Duinker, 1981; Duinker and Nolting, 1976; Martin and Krauer, 1973).

Probably the observed contrasts also imply, that the suspended matter transported by the rivers is mostly trapped in the estuary. Only a small fraction of this material is transported to the sea, but remains here close to the coast. This assumption is supported by data from the Remote Sensing Programme that took place at the same time as our sampling programme (v.d. Piepen and Amann, 1986). According to the higher Ca, Mg and K content in the suspended matter from the Solo, compared to those of the Porong and the also high concentractions of those elements, in the suspended matter in the Surabaya to Solo mouth region, distribution of suspended matter transported by the river Solo is restricted to the Surabaya-Solo region, and suspended matter from the Porong is limited to an area south of Surabaya (Table IX).

6.2.2. Elements in Relation to Aluminium

Table III gives the element/Al ratio in the different regions and periods. There were large differences in the major element composition in the two rivers, but there was also a difference between the two periods. This is most evident for the Porong where as result of the higher current velocity in the wet period iron- and silica-rich materials were suspended, resulting in higher Si/Al and Fe/Al ratios. In the Solo there was also an increase in the iron and silicate content in the wet period, but at the same time Al increased too, so that the net result was a decrease in the Si/Al ratio and an almost identical Fe/Al ratio. As a result, instead of silica-rich material, there is an introduction of aluminium-rich material. Taking into account that the two different sampling periods can have a different influence on the composition of suspended matter, a change in the Ca/Al, Mg/Al and K/Al ratios in the two rivers is be expected. These ratios were all higher in the Solo river, as is confirmed by the data obtained from the preceding longitudinal survey (Table III).

Mineralogical studies show that the Porong river contained more feldspars than the Solo river and the Solo more quartz than the Porong (v.d. Gaast, personal Communication).

The conclusion, that the suspended matter carried into the Solo estuary and Surabaya to Solo mouth track is mainly material from the Solo river can be confirmed by considering the element /Al ratio (Table III), the higher Ca/Al, K/Al and Mg/Al ratios that occur in the Solo river and estuary are also found in the latter region.

The sum of the oxides of the elements (MnO_2, SiO_2, Al_2O_3, K_2O, Fe_2O_3, MgO and CaO) was 52% in the dry period in both rivers and 57.5% in the second. This implies that a large amount of organic matter is present in the two rivers and that this amount is somewhat higher in the dry period than in the second

If we accept a mean value for the organic content in the suspended matter of 48 and 40% and thus multiply our data with a factor 100/52 and 100/60, we can compare our data with those of other rivers (Table IV). Under tropical conditions, especially vulcanic soils are subject to intense chemical weathering. This leads to the mobilisation of large quantities of silica, calcium, magnesium, potassium, and sodium. The high dissolved silicium content found by us in the rivers, proves that this process is also occurring here. However, there were the differences in the two sampling periods, our data are most comparable with those of the Amazone. Compared to rivers in a more moderate climate, the supended matter in the Solo and Porong is depleted in Si, Ca and K and Mg (Porong)) and relatively more enriched in Al than in Fe (Table V).

6.2.3. Contribution to the Total Metal Content in the Water Phase

Fig. 23A presents the amount of metal in suspended matter in the Java Sea and Strait of Madura which contributes to the total amount of metal present in the water phase. This amount depends on the amount of suspended material present. In most marine cases, the contribution of particulate Cu, Zn, Cd, Ni and Pb to the total element concentration is lower than the contribution of those elements in the dissolved phase. In the rivers Solo and Porong the amount of metal in the suspended matter is almost superior to that in the dissolved phase.

6.2.4. Leachable Portion of the Metals in the suspended matter

There is an appreciable difference in the percentages of an element that can be leached from the suspended matter. Leaching by a mild chemical solution (0.1 n.HCL) gives an idea about that part of a specific element that is easy exchangeable, and the part that is firmly fixed or bound in suspended particles. The mean percentages of the total metal content of material from the Solo and Porong that were leached by 0.1 n.HCL were: Cd 100%, Zn 85%, Cu 30-50%, Pb 30-90%, Cr 30%, Mn 98-100%, Fe 15-30%, Ca 100%, Al 0-15%, Si 0%, Ni 20-75%, K 50-80% and Mg 60-80%. These values represent the mean ranges in all the areas studied and in different sampling periods.

Leachable percentages decreased in the rivers for most elements in the wet period, especially in the Porong where current velocity and suspended load were high. This decrease is most evident for Cr, Fe, Al, Ni, K and Mg, indicating that the less leachable portions of these elements are associated with the coarser fraction of suspended matter. Duinker et al., (1982a, 1982b, 1985) reported similar results for the Ems, Weser and Elbe rivers. As an example we compare our data from the Solo and Porong rivers with those of the latter rivers (Table VI). Differences between those rivers are small. However, Cu and Fe show a lower leachable portion in the Porong and Solo material and Al a higher one especially in the first sampling period. The very low dissolved concentrations of some elements in the Solo and Porong are probably an explanation for the lower leachable fractions in the suspended matter

6.2.5. Comparison with other Rivers

Table VII gives some data of the Cu, Zn, Ni, Cr, Cd, and Pb content in suspended matter from the Porong and Solo in comparison with those of some other rivers. A fair comparison is not always possible because, as already noted, the trace metal percentage changes inversely with the of suspended load. This effect explains some higher values. The lowest concentrations in the Porong and Solo are in fair agreement with those of the mean world rivers, Whereas the highest concentrations, mostly those from the dry period are correlated with the lower amount of suspended matter that was available (Duinker et al., 1982a, 1982b, 1986; Martin et al., 1984). Only material from the Rhine river which flows through a heavily industrialized area shows high concentrations for Cu, Zn and Cr.

7. CONCLUSIONS

Dissolved concentrations of the metals Cu, Zn, Cd, Ni, Pb, and Fe in the rivers and coastal waters around Java and Bali are comparable with those in other parts of the world. They have a normal distribution pattern, with for most elements higher concentrations in the rivers, which concentrations decrease in offshore direction. The lowest concentrations were found in the Indian Ocean. However, the rivers have their influence on the coastal zone, this is mostly only observable in the vicinity of Surabaya. These concentrations are however, rather low, and only occasionally higher values were observed. In these rivers mobilization and removal processes were difficult to observe. The mixing of rather hetergeneous water masses with different metal concentrations were maybe responsible for this situation. Only Cu showed a more or less conservative behaviour. This heterogenity is maybe caused by the mud barrieres in the mouth of the rivers, which prevent a fast mixing of saline and fresh water.

The vertical metal profiles in the Indian Ocean showed the same characteristics as those in the Pacific and Atlantic oceans. Cd concentrations are equal to those in the Pacific. The correlation between Cd and phosphate is comparable to those in the Atlantic ocean. Deep water nickel concentrations are between those in the Atlantic and Pacific Ocean. There excist a good correlation between zinc and silicate.

Suspended particulate matter in the rivers contained a high precentage or organic material of about 40-50%. The suspended load was much higher in the second than in the dry period. The higher amount of suspended material with a high coarser fraction decreased the relative concentration of the trace metals in the suspended matter It decreased also the leachable fraction of Cd, Pb, Cr, Fe, Al, Ni K and Mg. Indicating that the smaller finer fraction has a higher leachable metal capacity. The high dissolved silicium concentration accounts for a high chemical weathering of the soils. Indeed, we find a low silicate aluminium ratio, inducating a decrease of the silicate content with a subsequent relative increase of aluminium and iron which is comparable to other tropical rivers. In accordance with the element/Al ratios, it is acceptable to define the transport of the suspended matter by the rivers as very limited to the coastal zone. Further from the coast the suspended matter is mostly organic. Material transported by the rivers can be distinguished by their difference in elemental composition. On this fact we can consider that, suspended matter in the Surabaya to Solo area is mainly supplied by the Solo. The influence of the Porong river is restricted to a small part of the coastal area of Java. These observations are supported by data obtained with the remote sensing program which can however, not make a distinction between different transport systems.

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8. PERSONNEL

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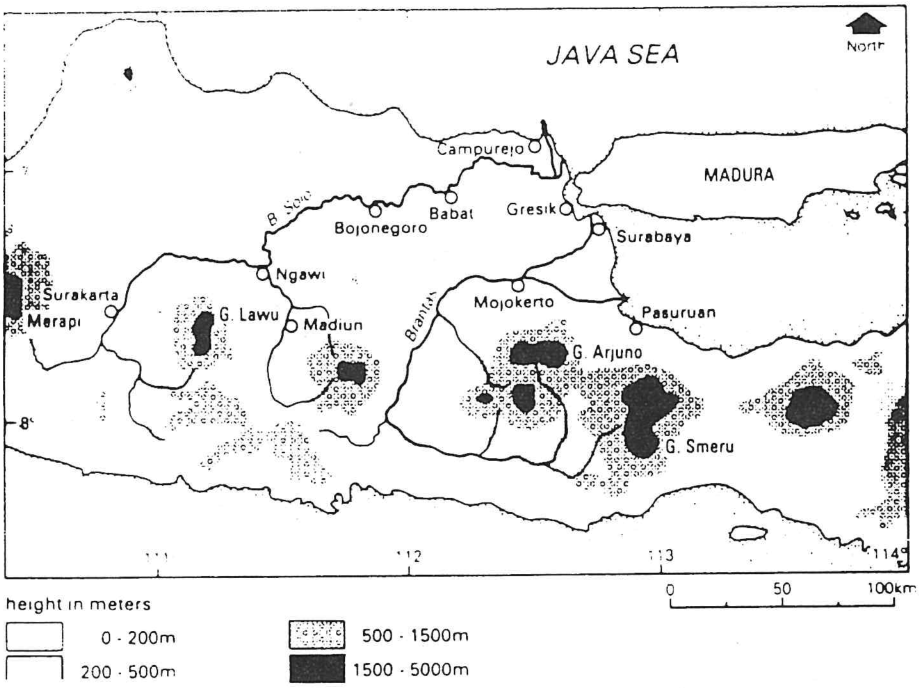


Fig 1

East Java and geographic setting to the Solo and Brantas river basins.

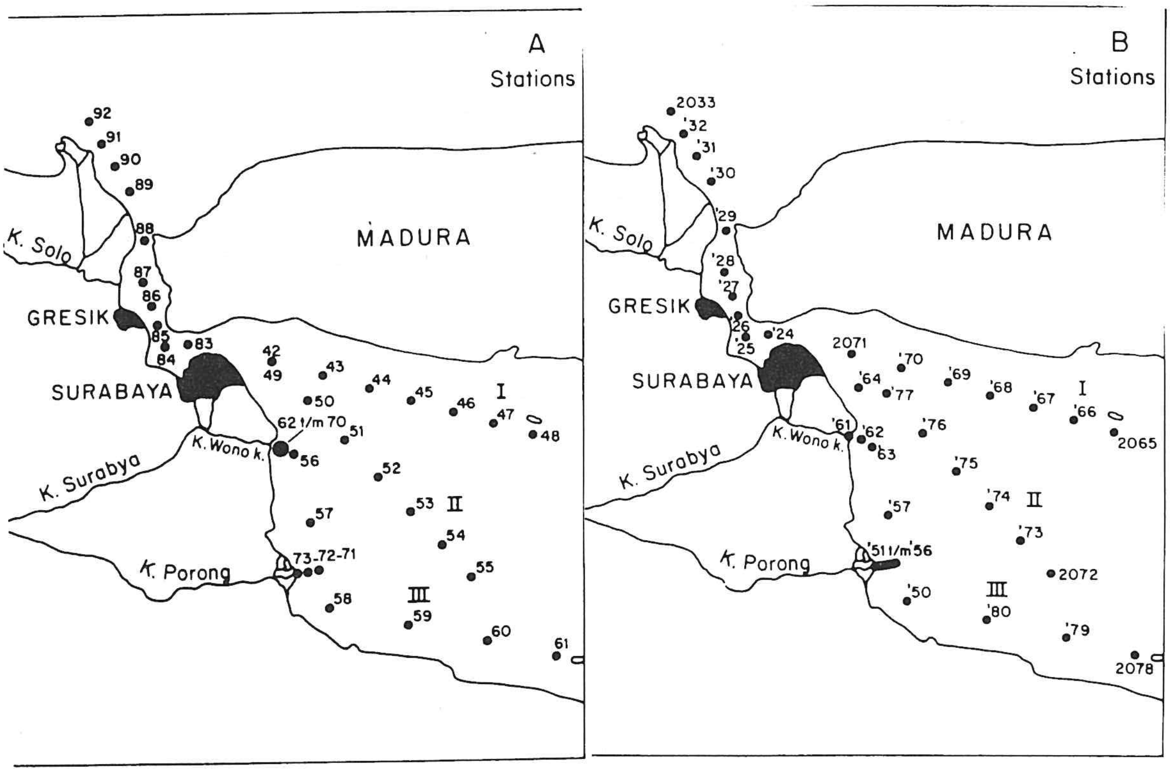


Fig 2

Station numbers in Strait Madura.
A. First period. B. Second period.

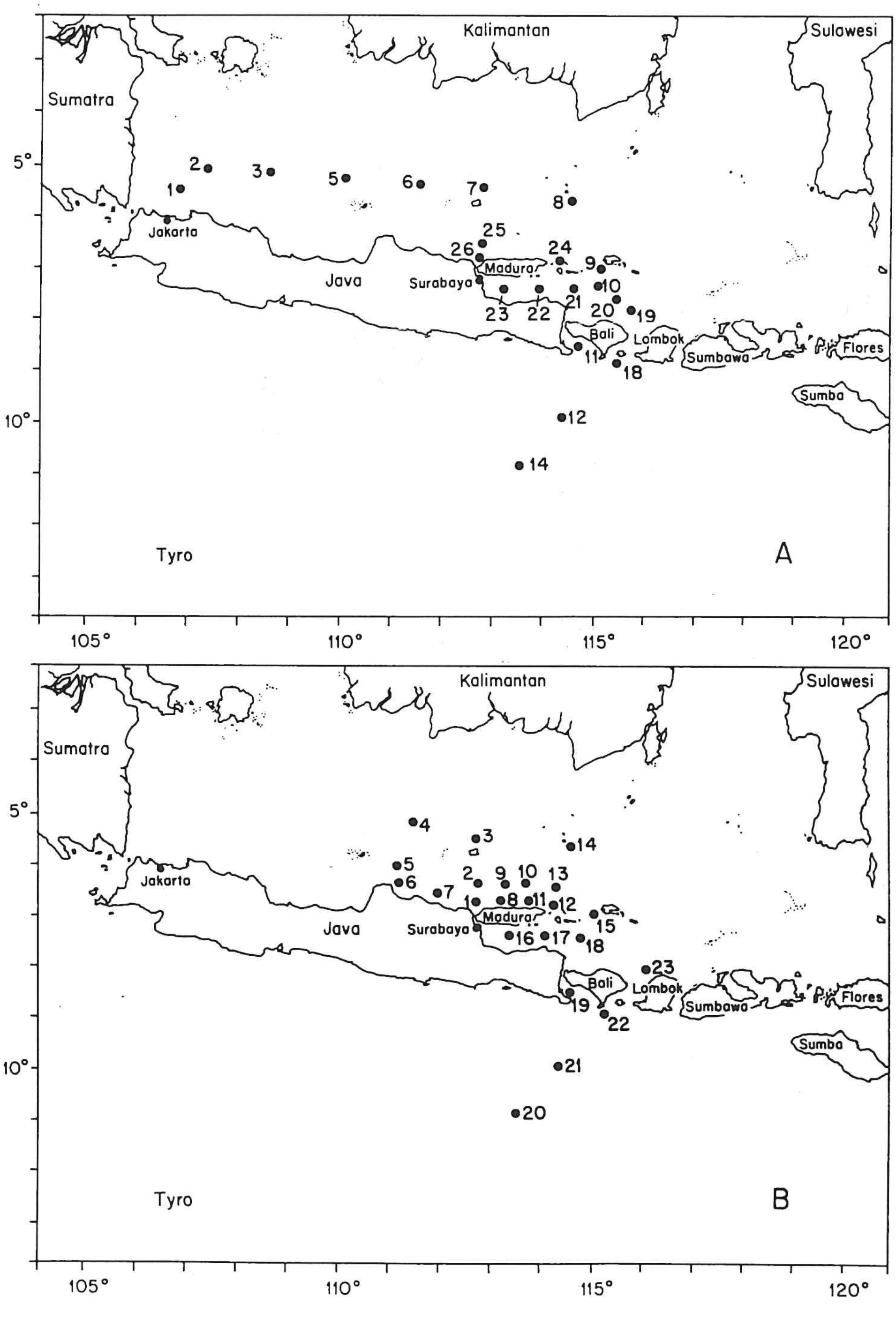


Fig 3

Station numbers in the different regions and periods.
A. First period. B. Second period.

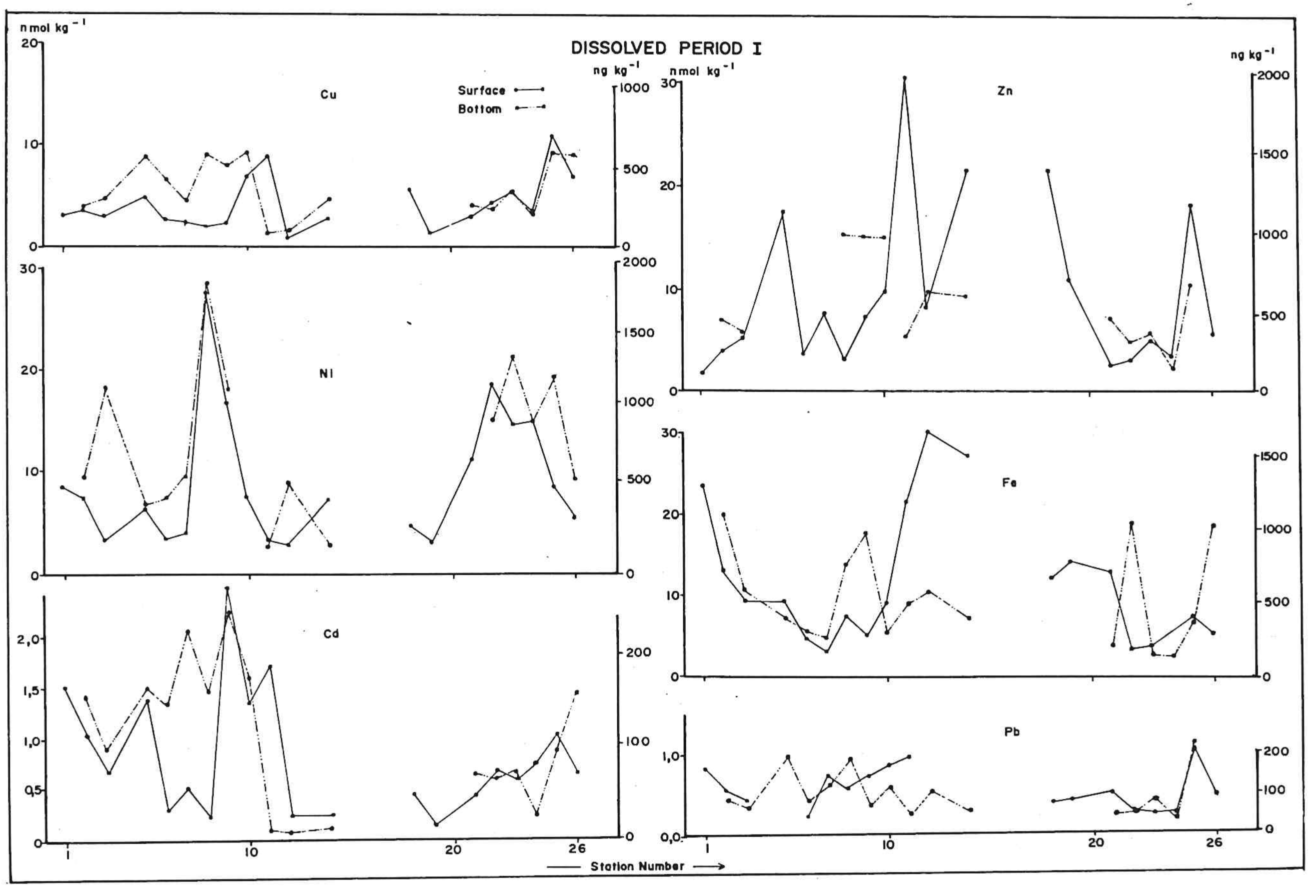


Fig .4A

Concentrations of dissolved Cu, Ni, Cd, Zn, Fe and Pb (ng.kg^{-1} and nmol.kg^{-1}) in the Java Sea and Indian Ocean (Tyro cruise I), surface data (._________.) and bottom data (.-...-.).

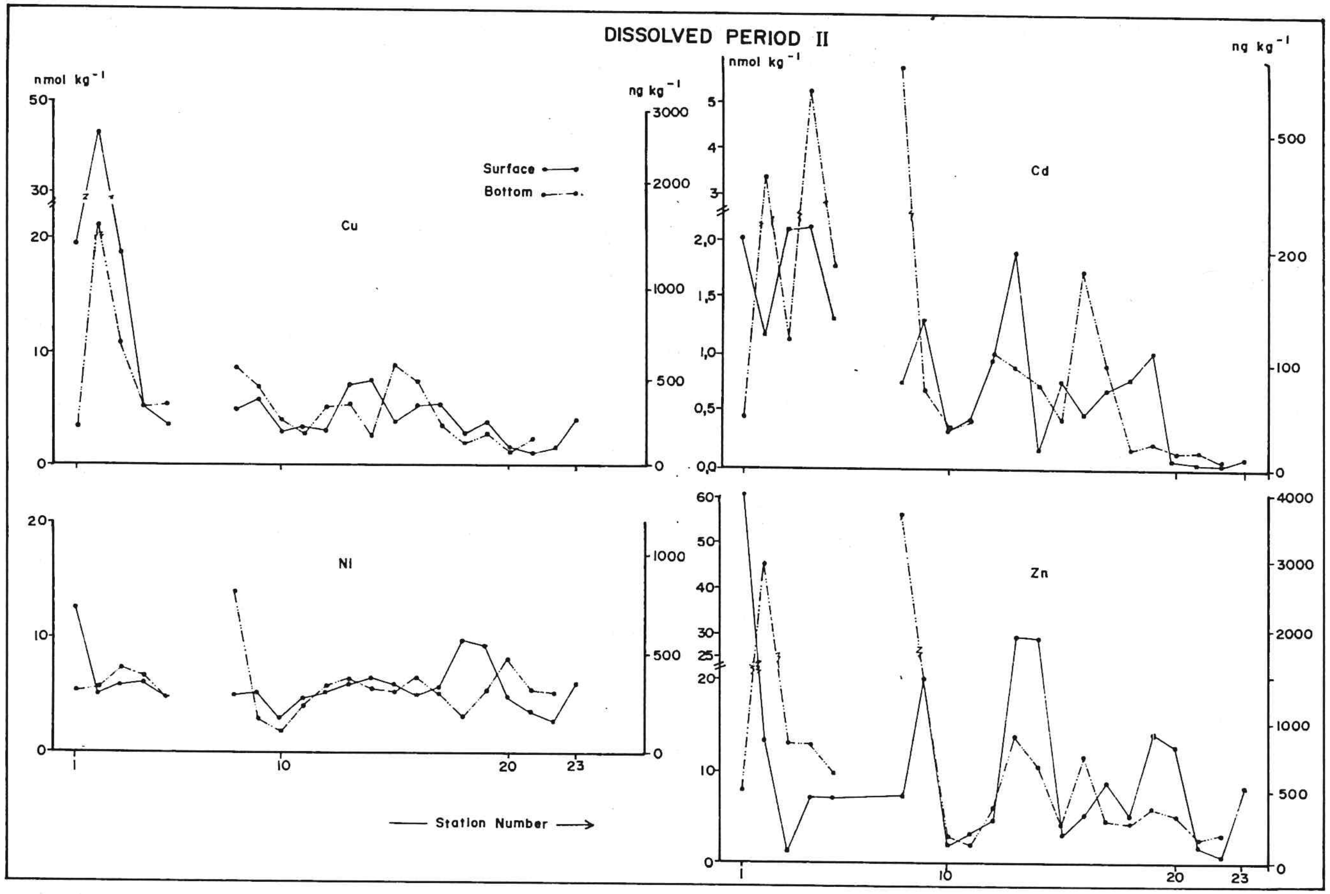


Fig .4B

Concentrations of dissolved Cu, Ni, Cd and Zn (ng.kg^{-1} and nmol.kg^{-1}) in the Java Sea and Indian Ocean. Tyro cruise II). Surface data (.-----) and bottom data (......).

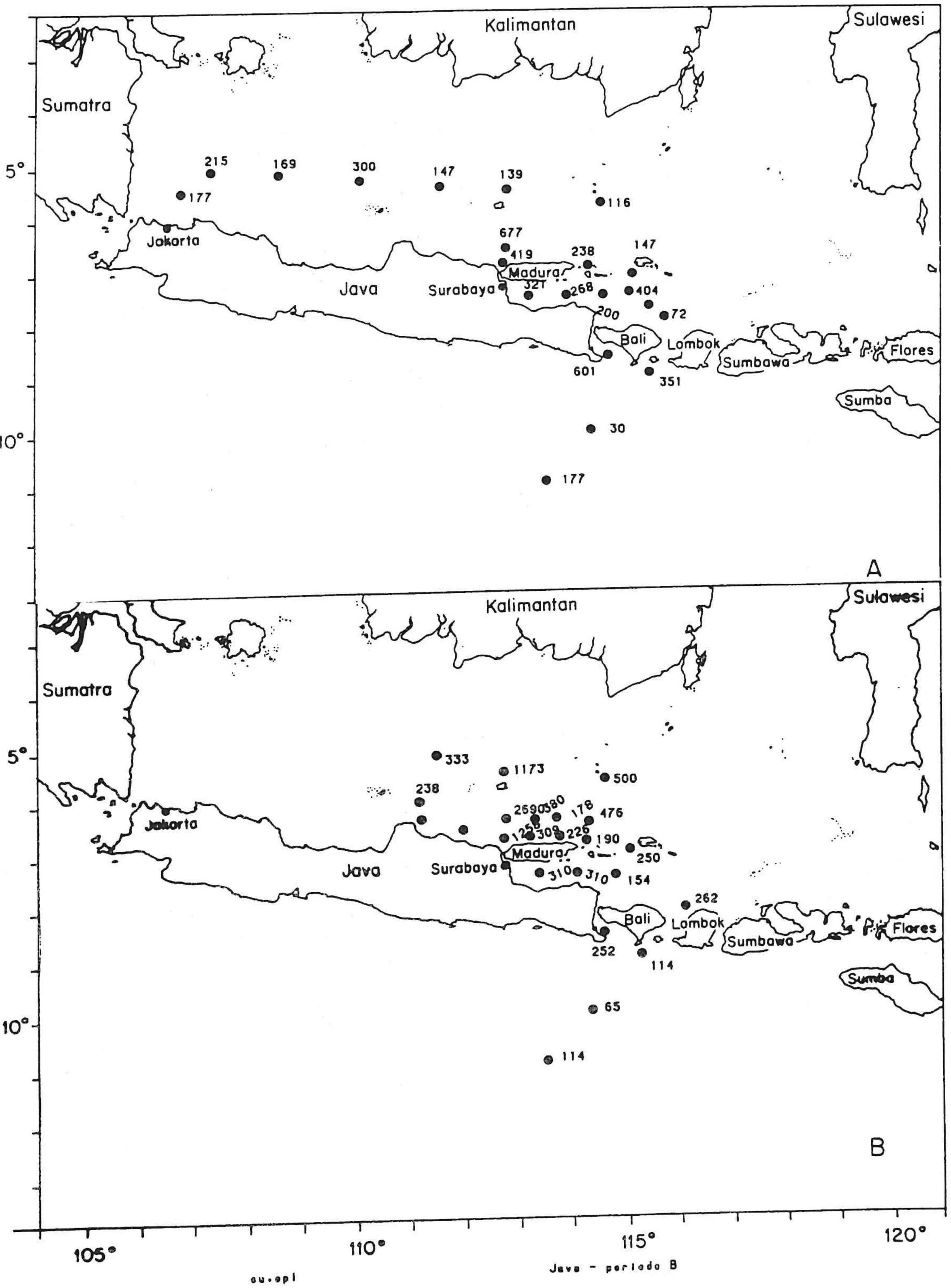
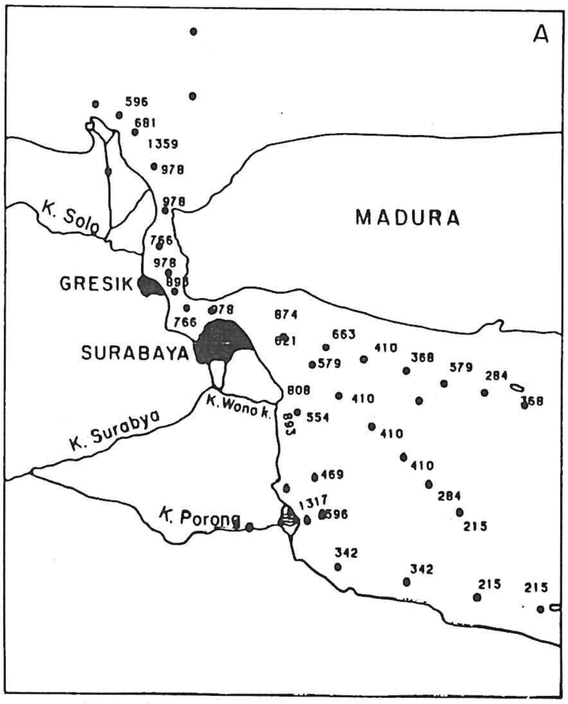
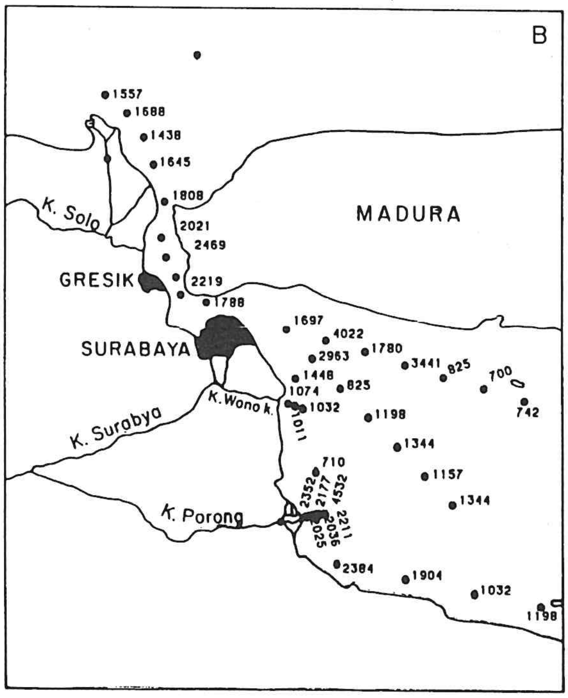


Fig 4, 5, 6, 7, 8 and 9

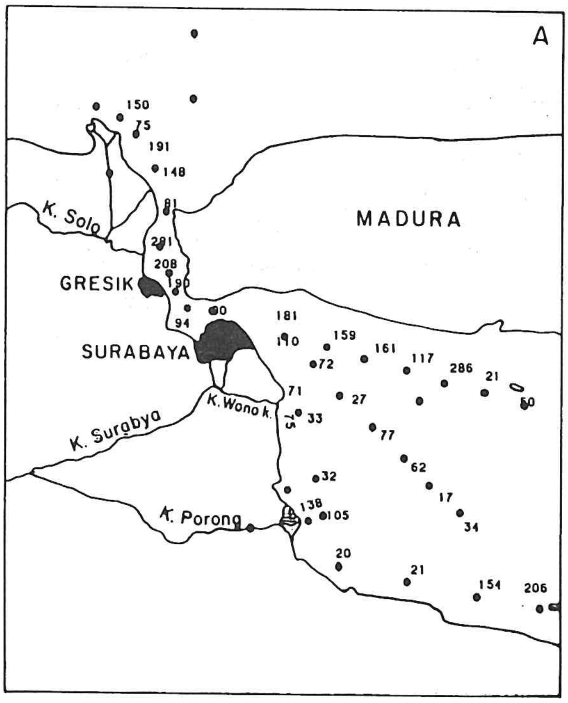
Concentrations of dissolved Zn, Cu, Cd, Ni, Pb and Fe ($ng.kg^{-1}$, Fe $\mu g.kg^{-1}$). A. First period. B. Second period.



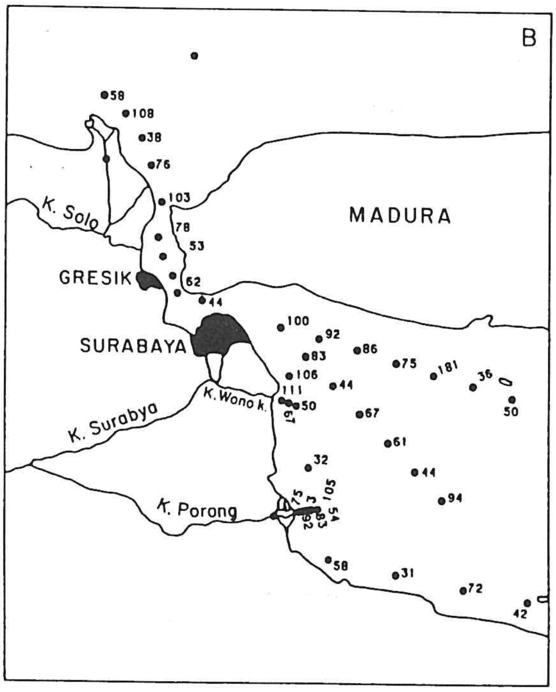
cu-opl Madura - periode A



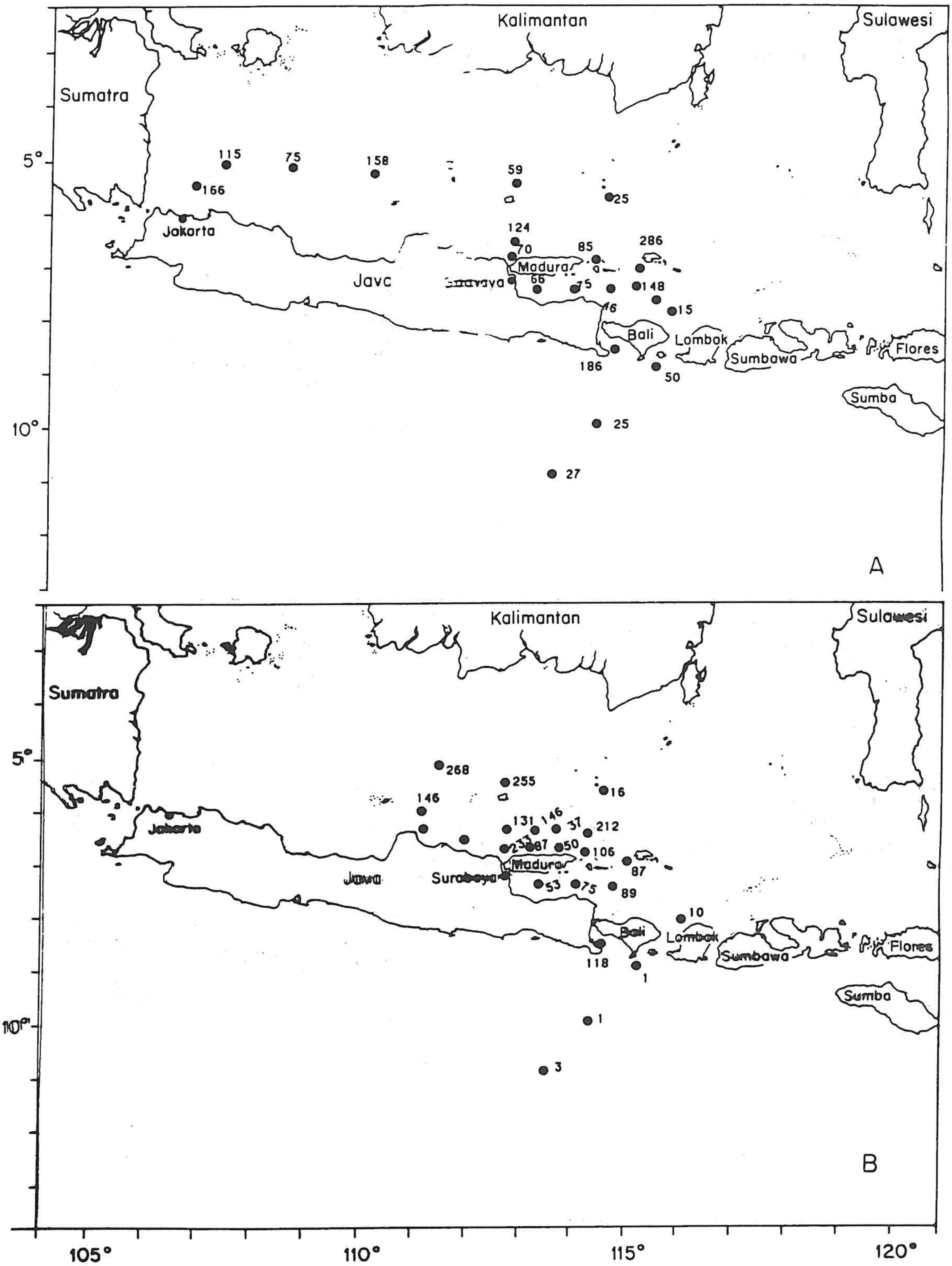
cu-opl Madura - periode B



cd-opl Madura - periode A

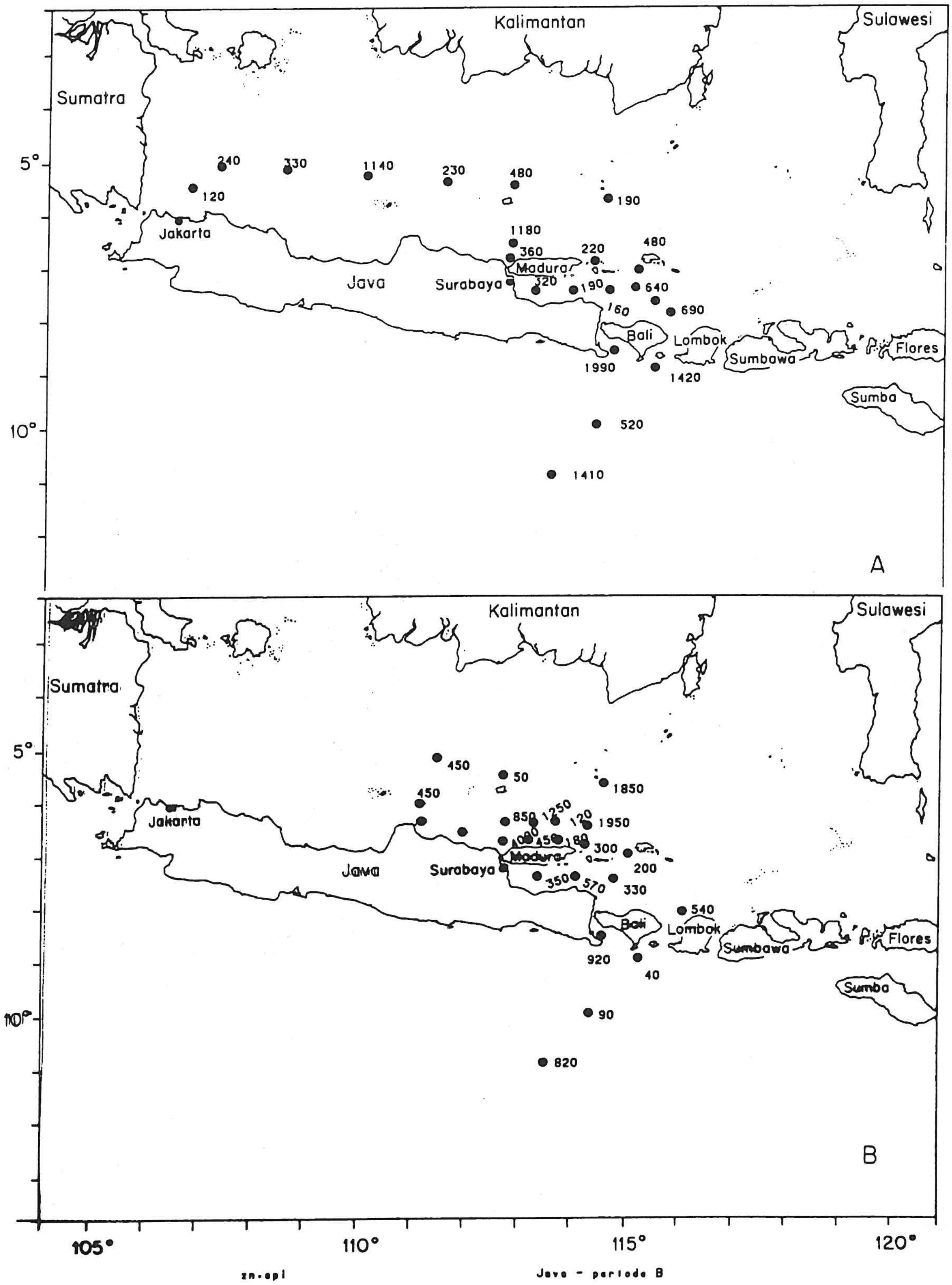


cd-opl Madura - periode B



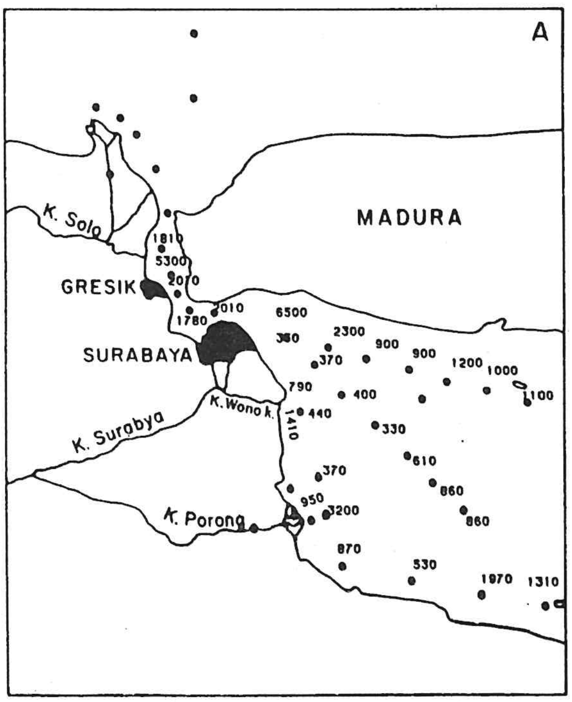
od-opl

Java - periode B

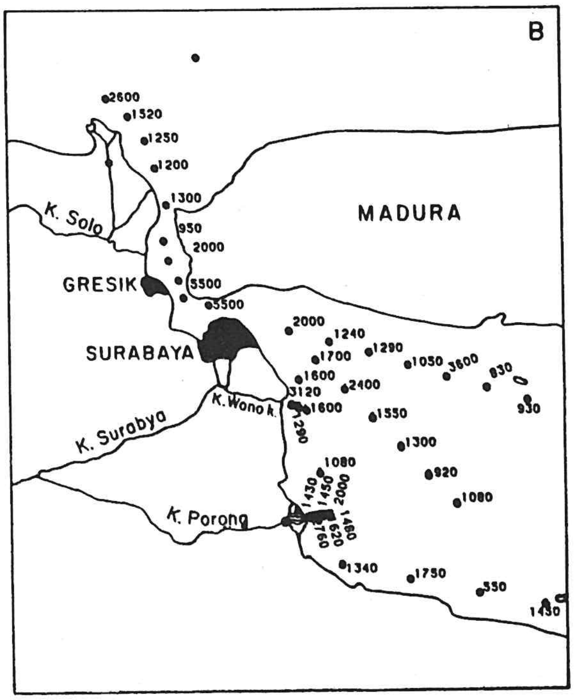


zn-opl

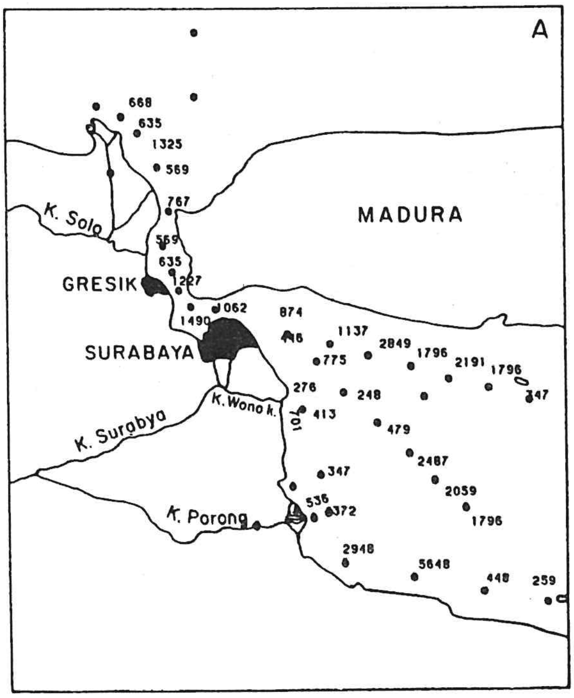
Java - periode B



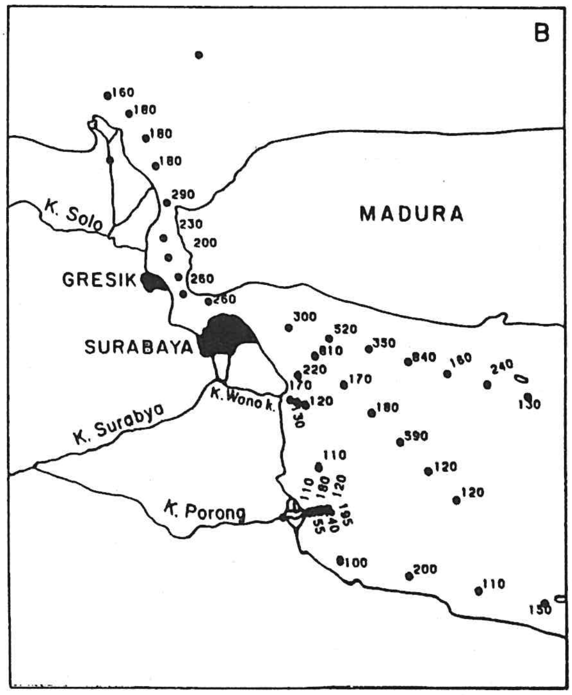
zn-opl Madura - periode A



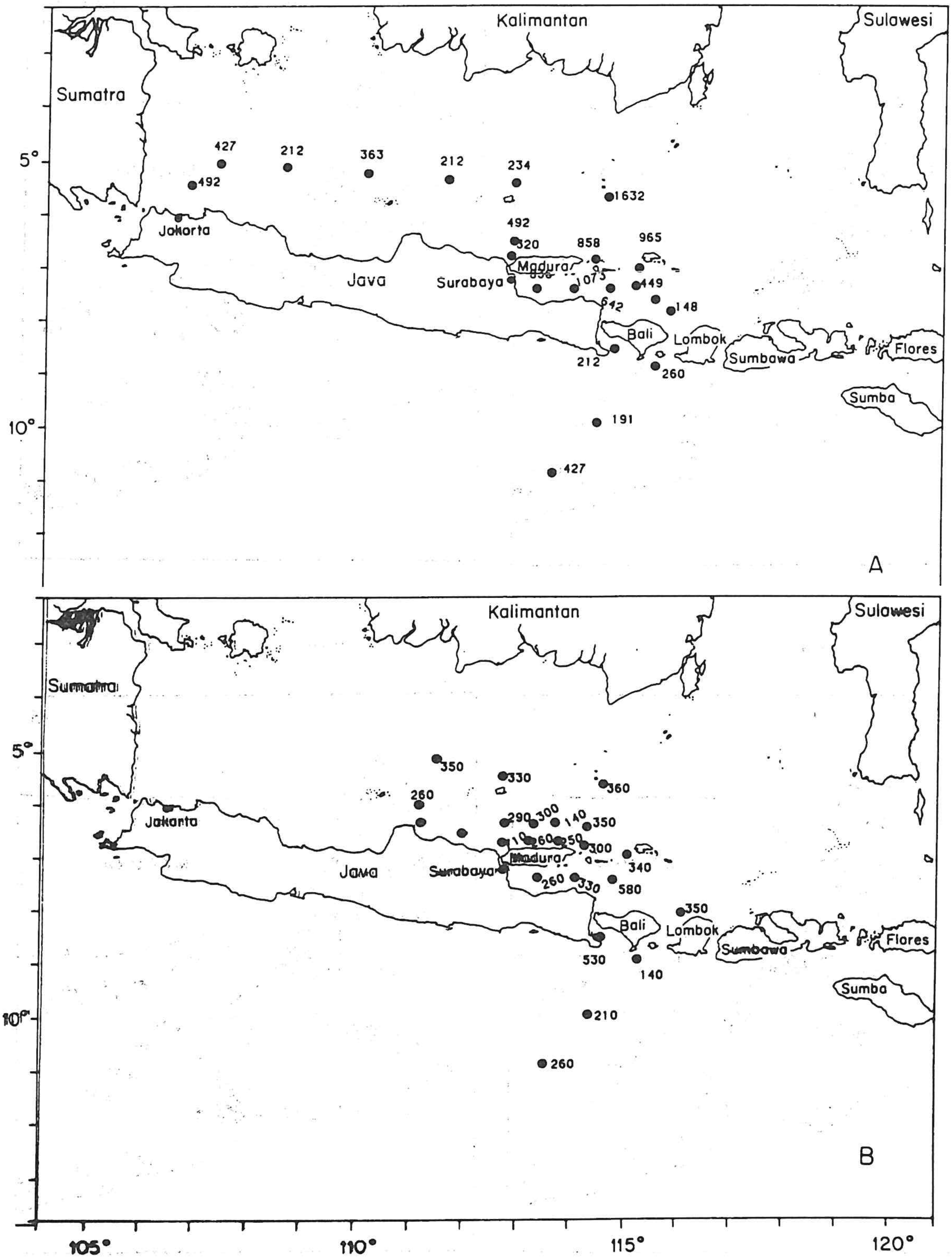
zn-opl Madura - periode B



nl-opl Madura - periode A

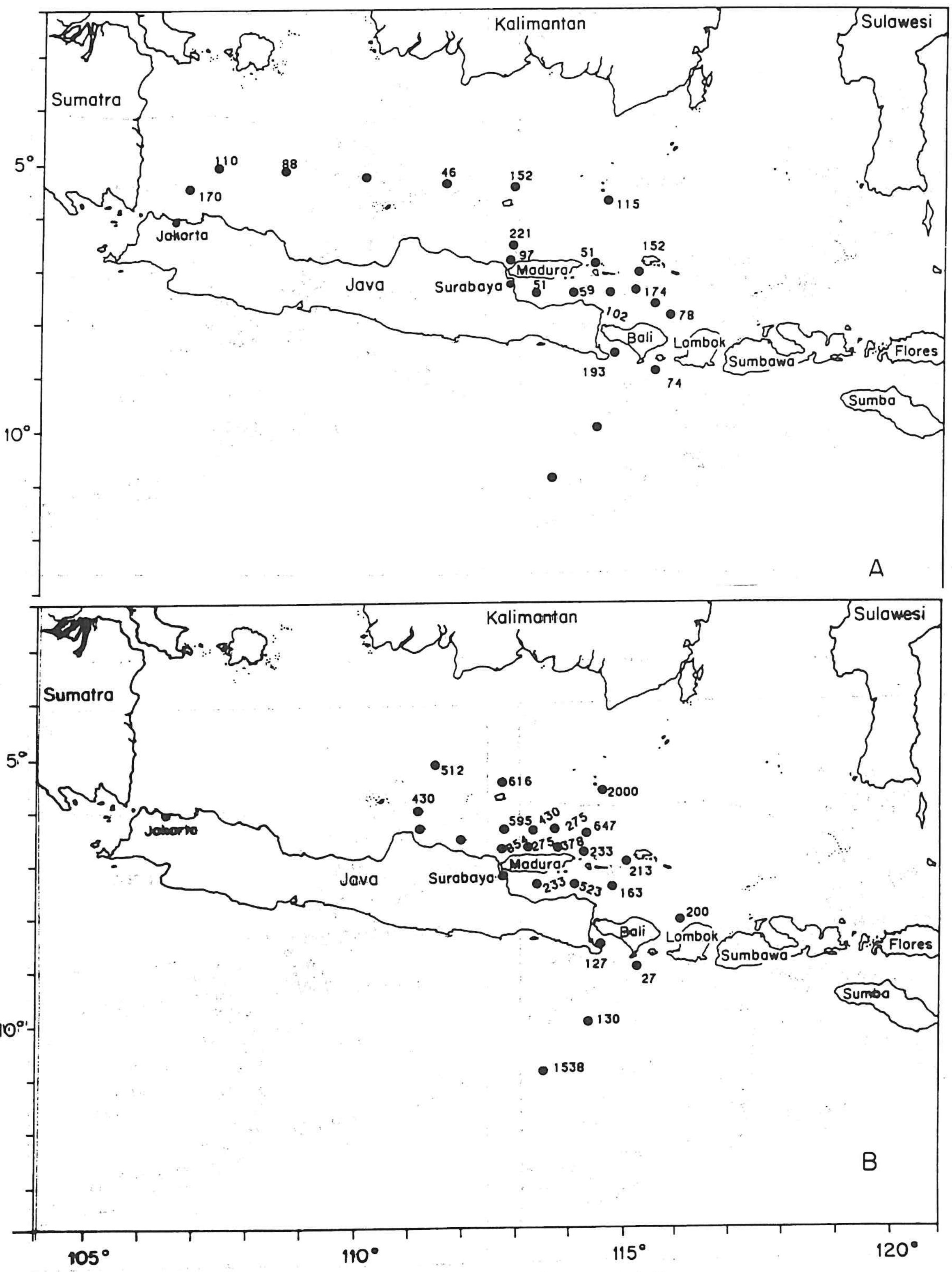


nl-opl Madura - periode B



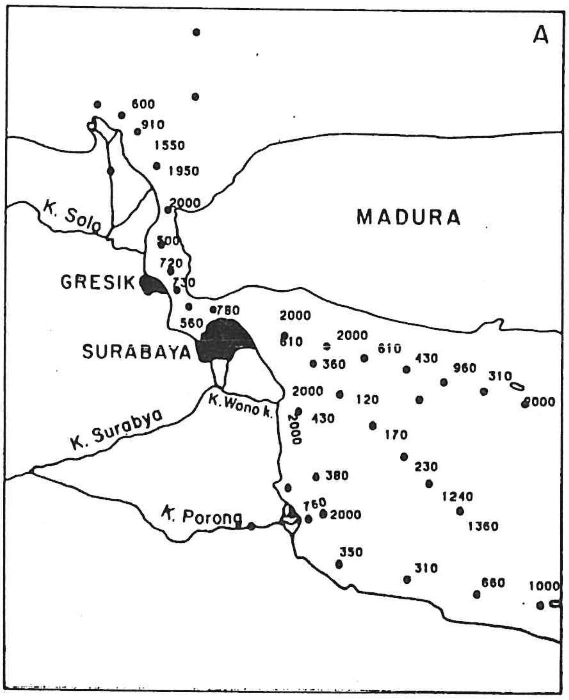
nl.opl

Java - periode B

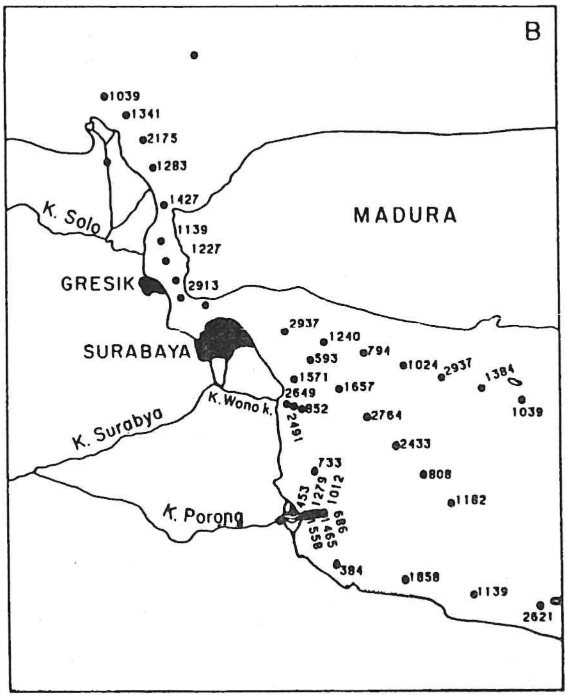


pb-opl

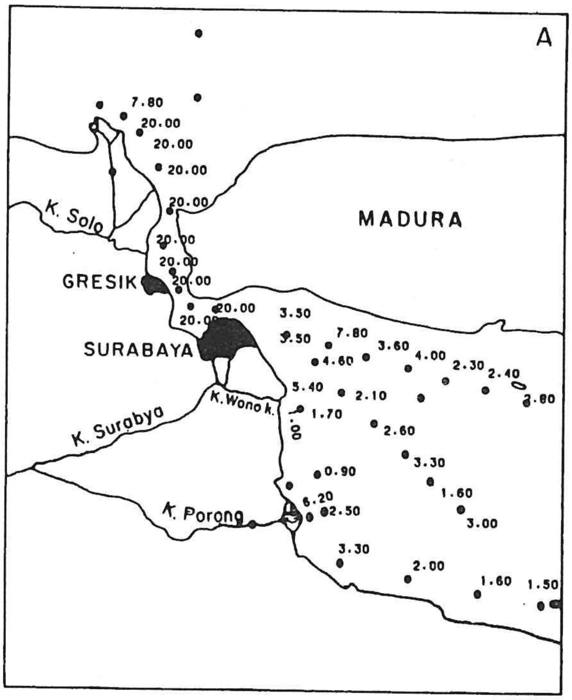
Java - periode B



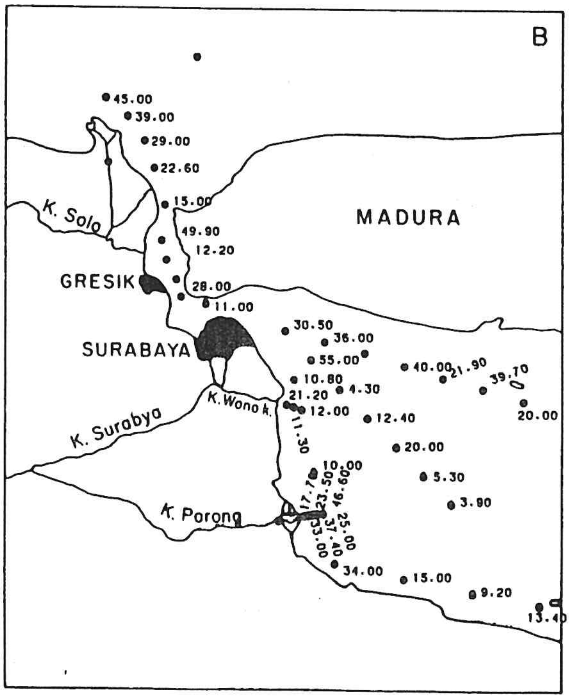
pb.opl Madura - periode A



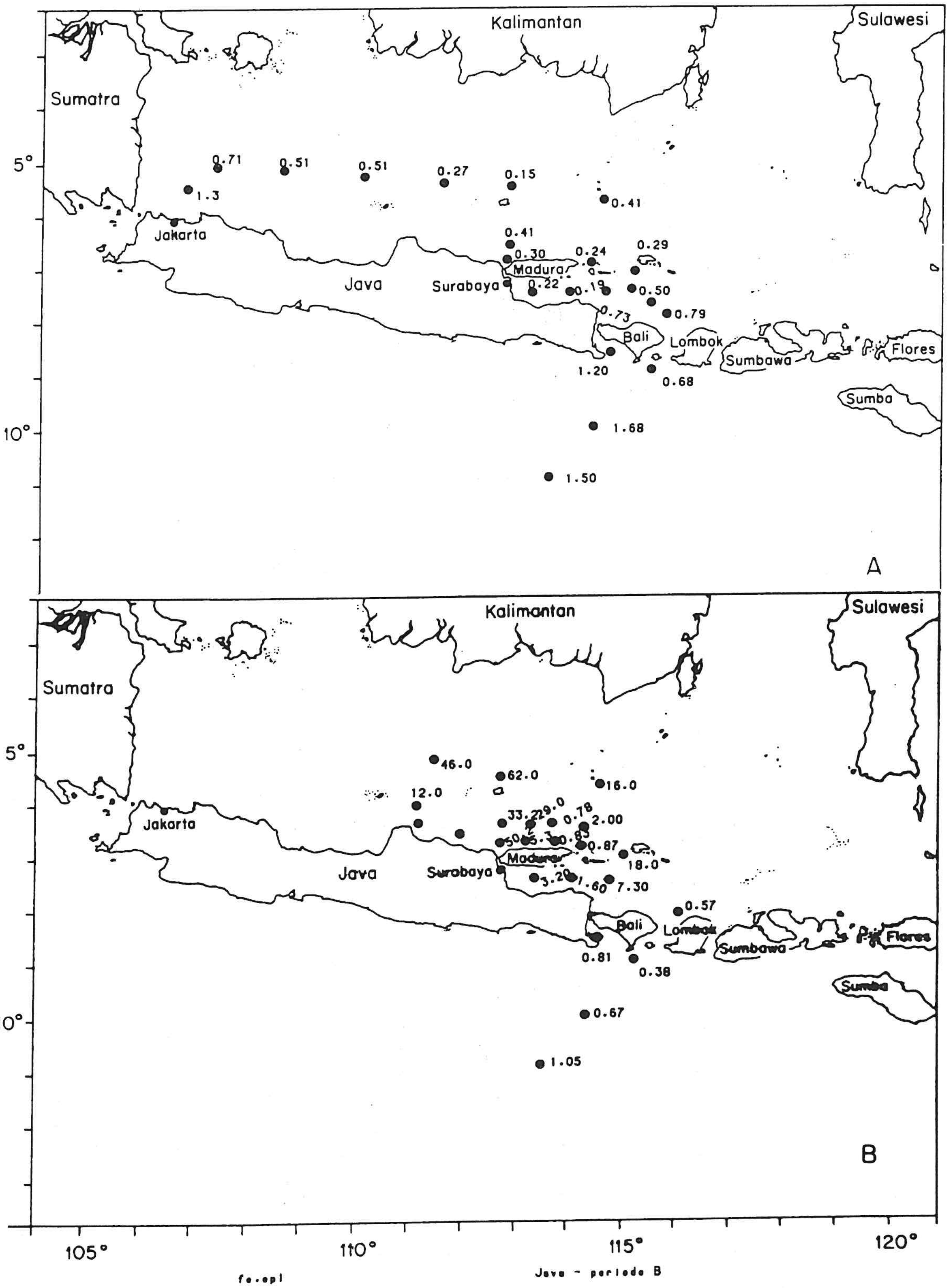
pb.opl Madura - periode B



fe.opl Madura - periode A



fe.opl Madura - periode B



Kalimantan
Sulawesi
Sumatra
5°
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0.71
0.51
0.51
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0.15
1.3
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Jakarta
0.41
0.30
0.24
0.29
Madura
Java
Surabaya
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0.19
0.50
0.73
0.79
Bali
Lombok
Sumbawa
Flores
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0.68
Sumba
1.68
1.50
A
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Sulawesi
Sumatra
5°
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62.0
16.0
12.0
Jakarta
0.78
2.00
0.87
Madura
Java
Surabaya
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7.30
0.57
Bali
Lombok
Sumbawa
Flores
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B
105°
110°
115°
120°
fe.epl
Java - periode B

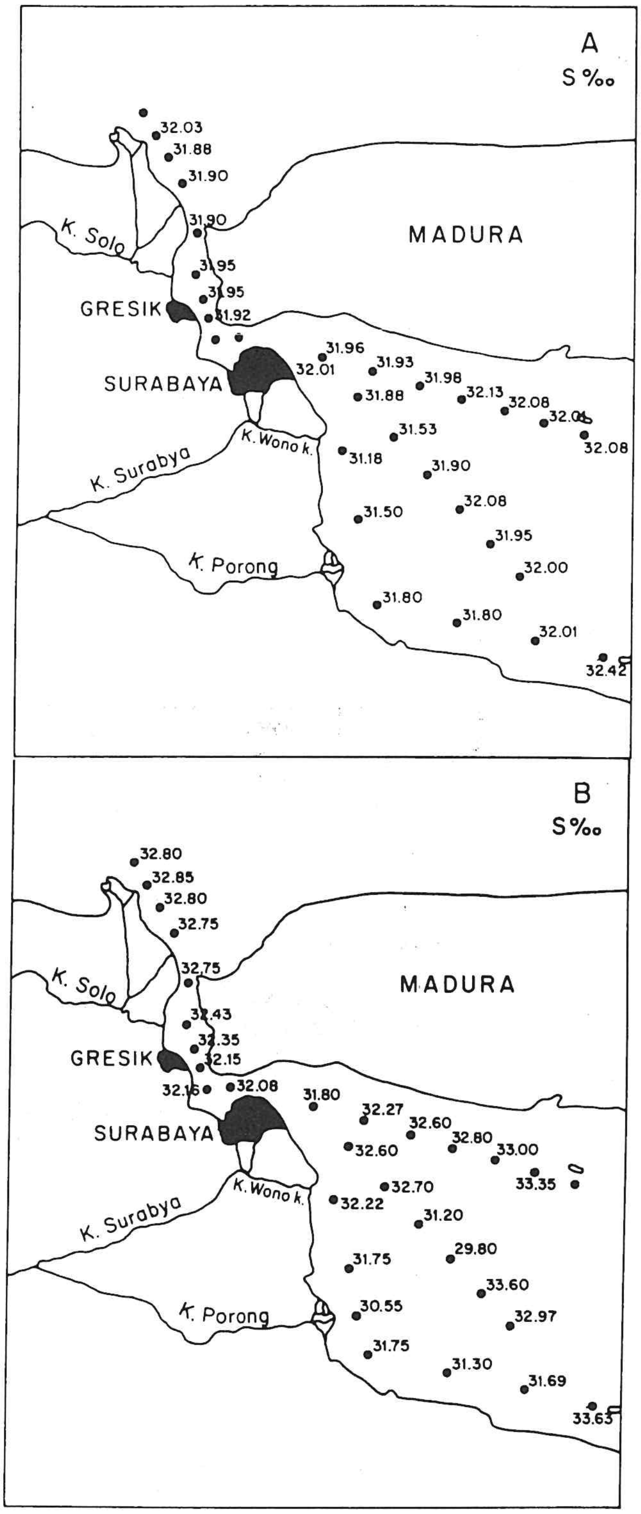


Fig 10

Salinity in the Madura strait. A. First period. B. Second period.

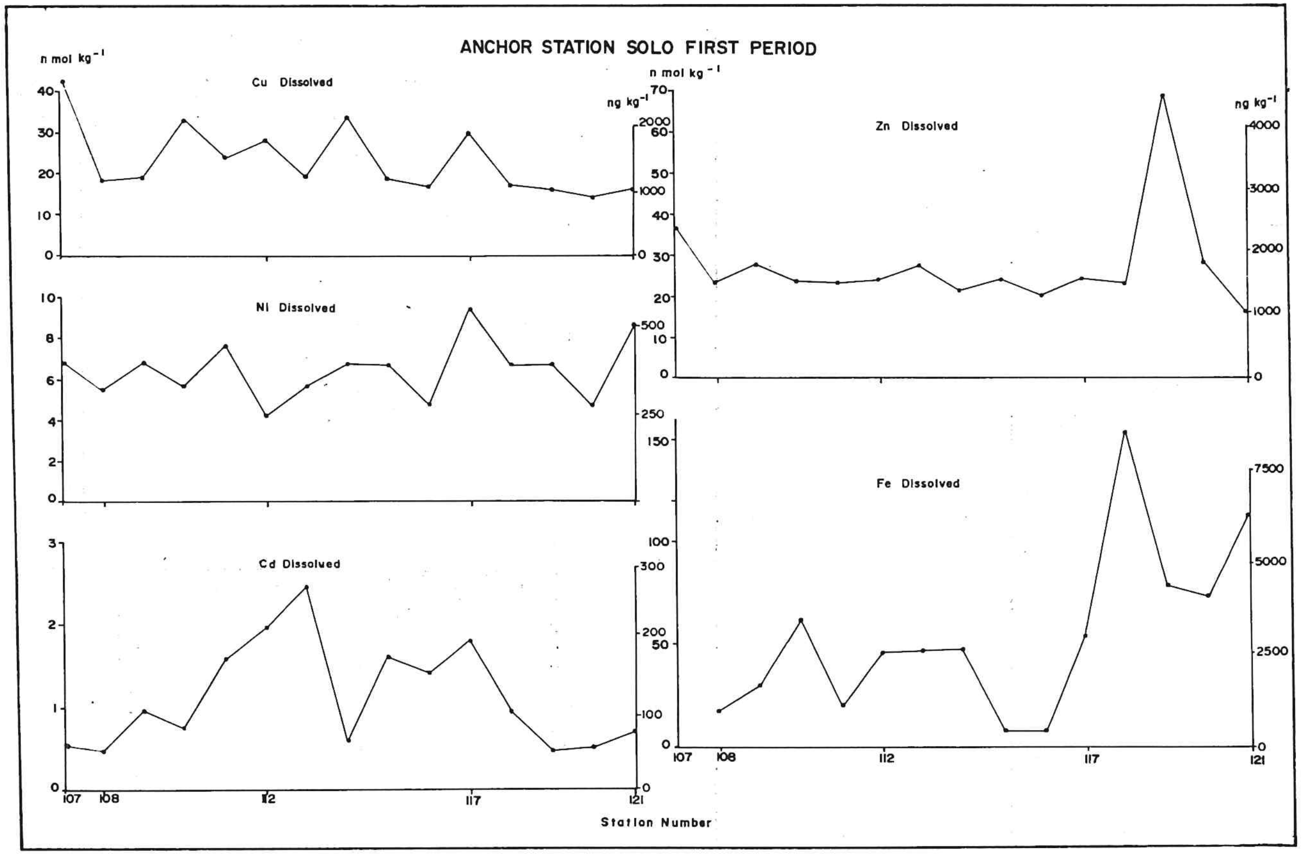
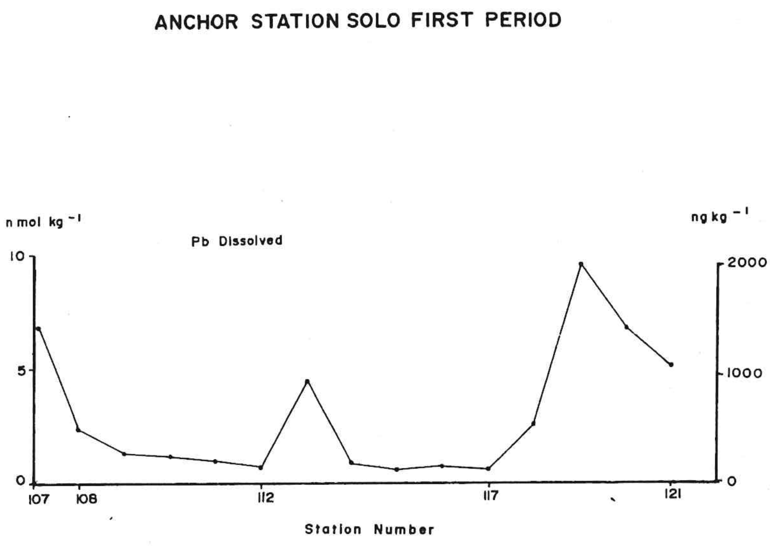
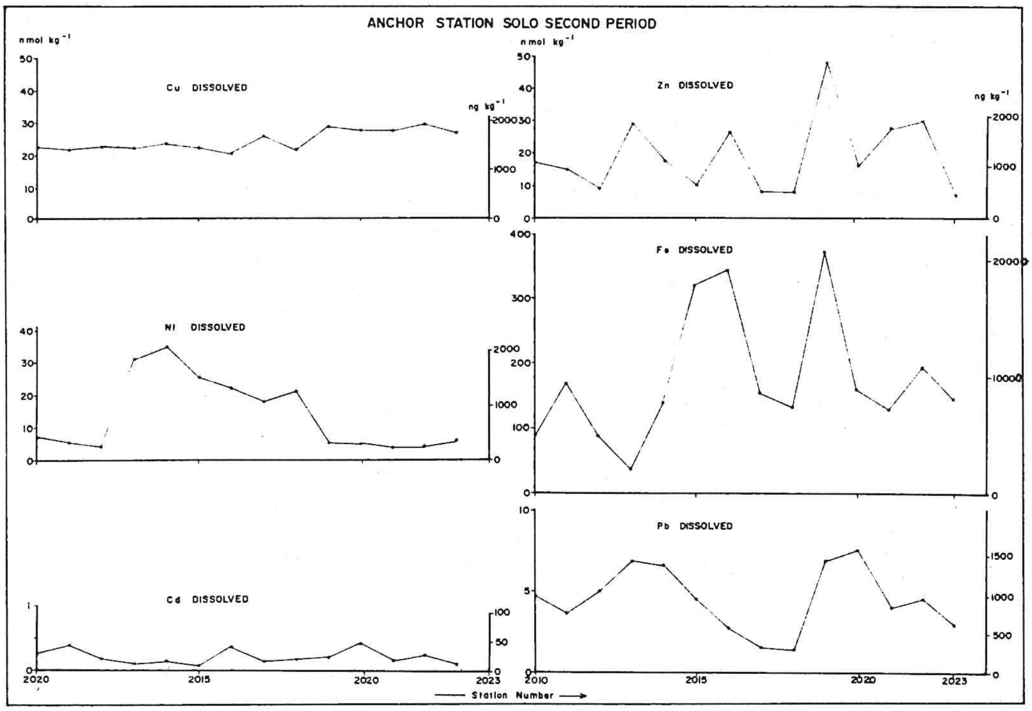


Fig 11, 12

Concentrations of dissolved Cu, Ni, Cd, Zn, Fe and Pb ($ng.kg^{-1}$ and $nmol.kg^{-1}$) in the river Solo. Anchor station, first and second period.


ANCHOR STATION SOLO FIRST PERIOD
n mol kg -1
ng kg -1
Pb Dissolved
10
5
0
2000
1000
0
107
108
112
117
121
Station Number


ANCHOR STATION SOLO SECOND PERIOD
nmol kg -1
Cu DISSOLVED
ng kg -1
Zn DISSOLVED
Ni DISSOLVED
Fe DISSOLVED
Cd DISSOLVED
Pb DISSOLVED
2020
2015
2020
2023
2010
2015
2020
2023
Station Number

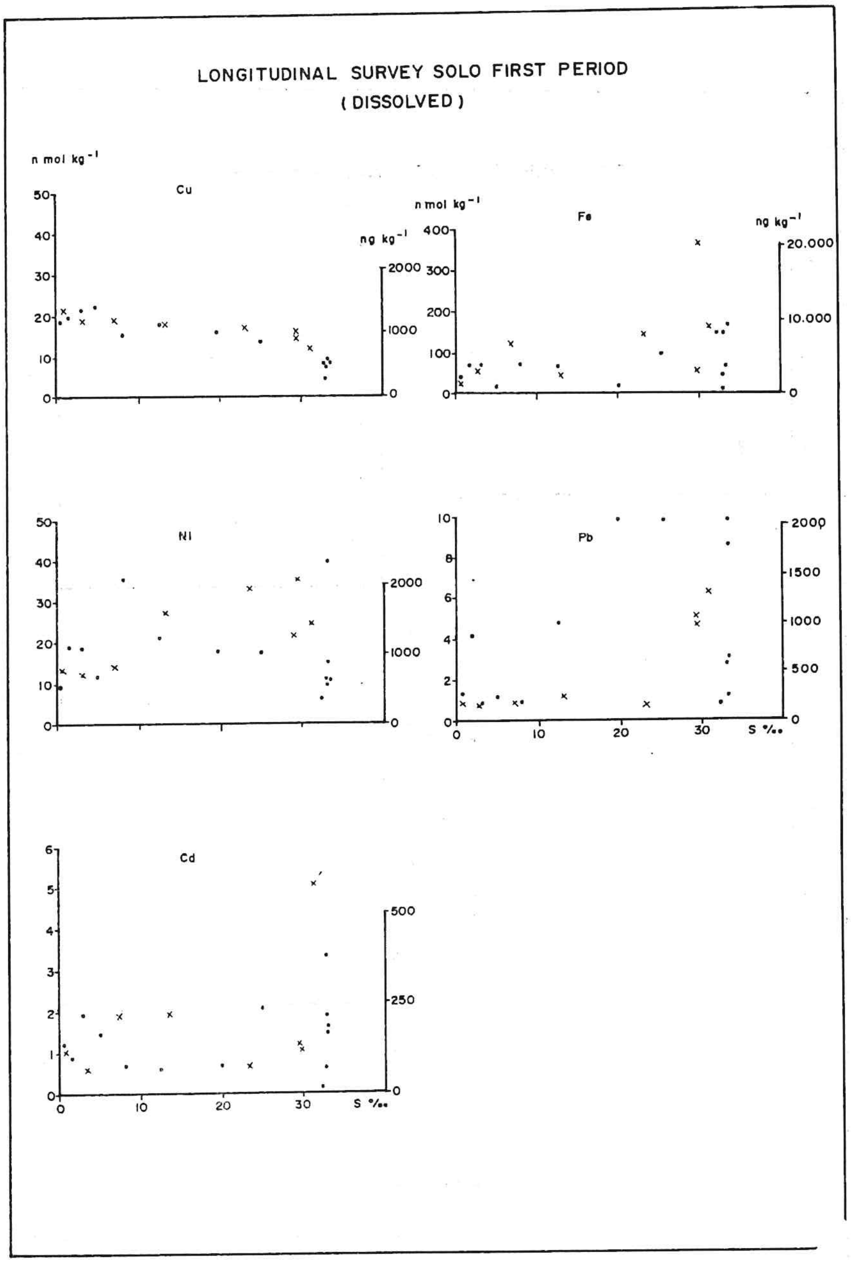


Fig 13

Concentrations of dissolved Cu, Ni, Cd, Fe and Pb ($nmol.kg^{-1}$) against salinity in the longitudinal survey of river Solo First period.

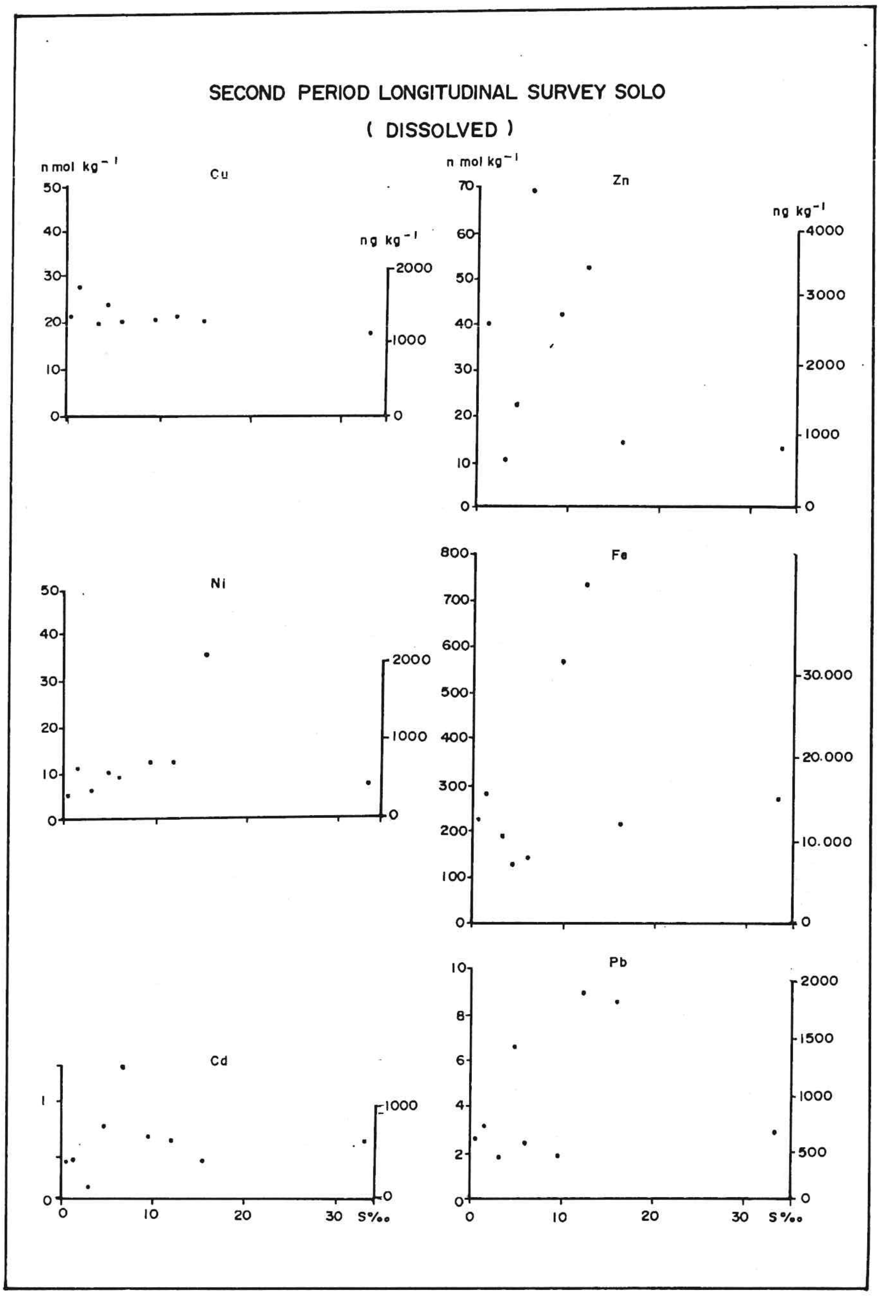


Fig 14

Concentrations of dissolved Cu, Ni, Cd, Zn, Fe and Pb against salinity in the longitudinal survey of the river Solo. Second period.

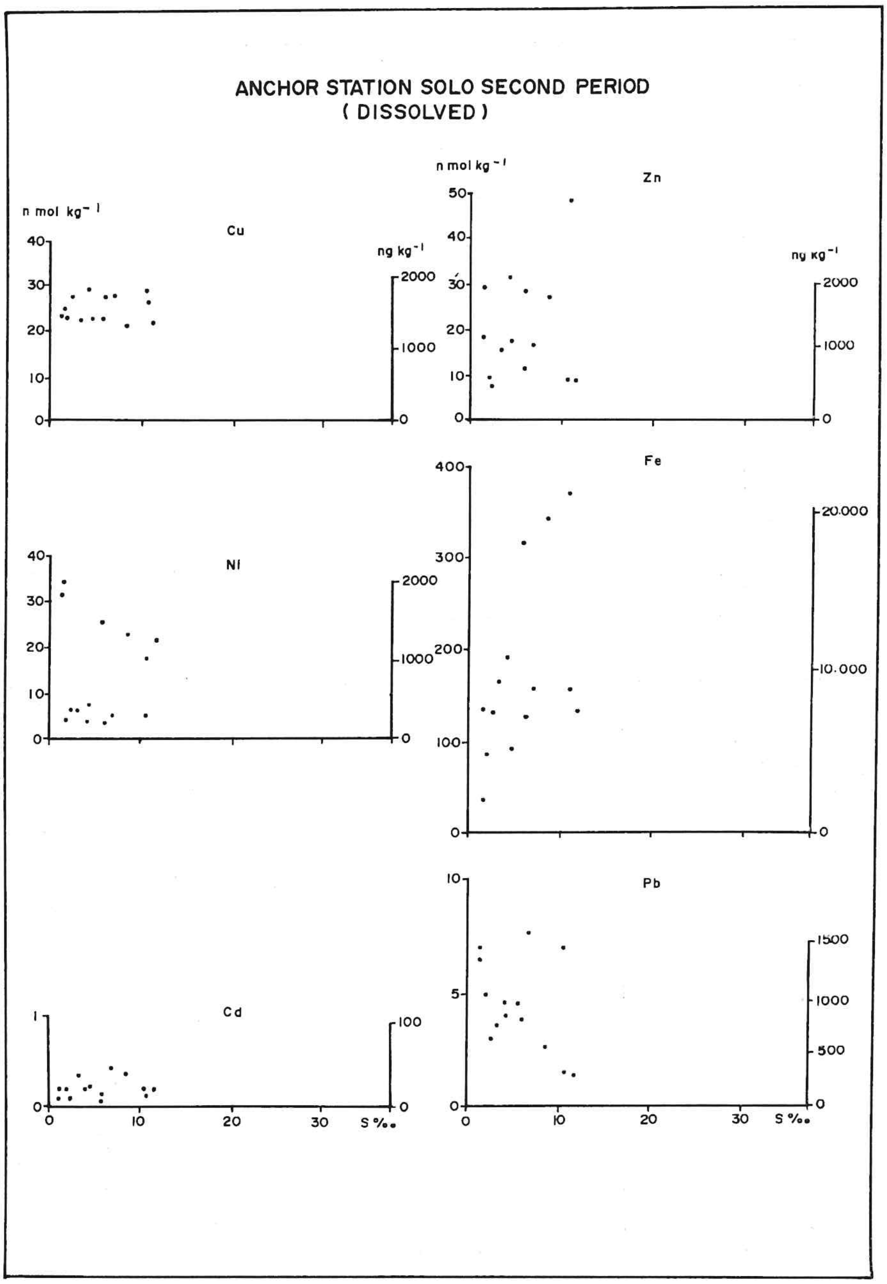


Fig 15

Concentrations of dissolved Cu, Ni, Cd, Zn, Fe and Pb ($nmol.kg^{-1}$ and $ng.kg^{-1}$) against salinity at the river Solo anchor station; second period.

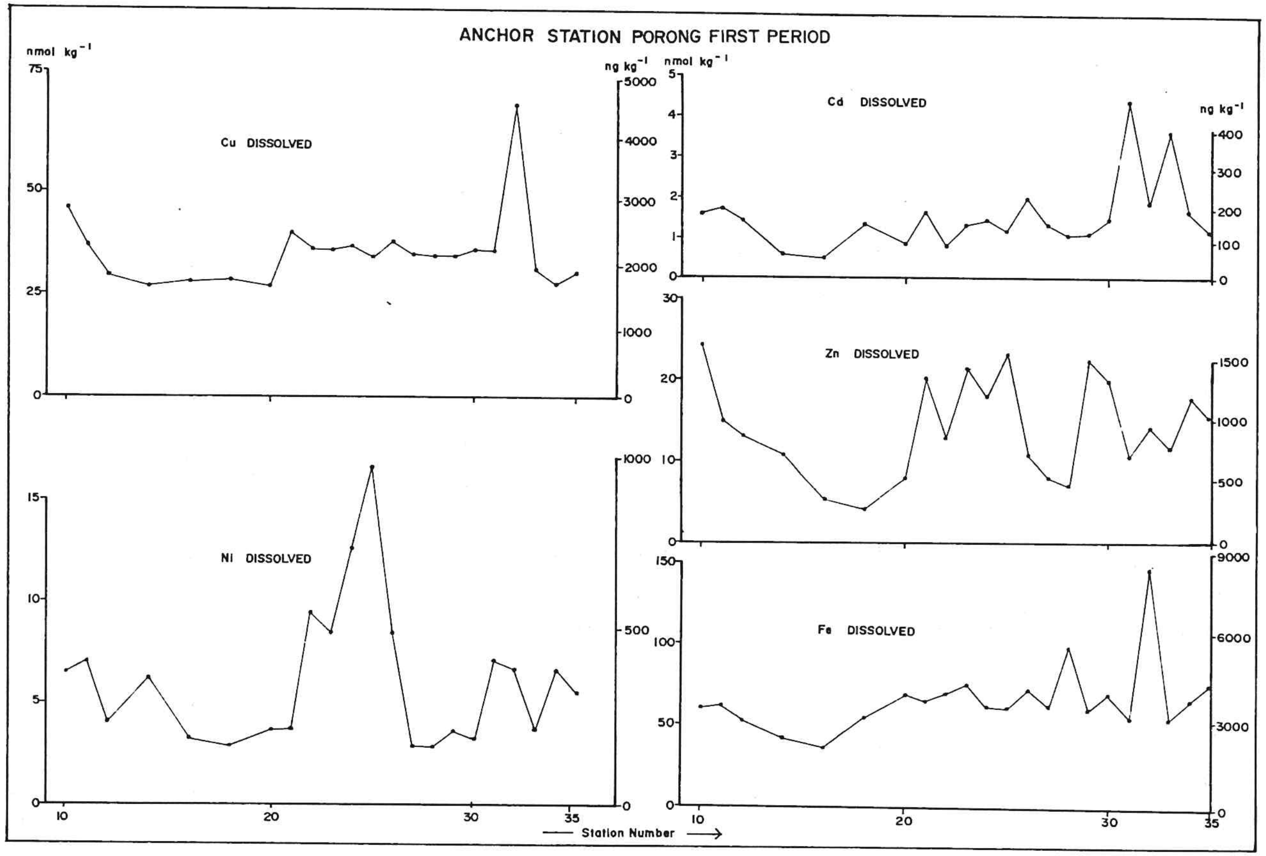
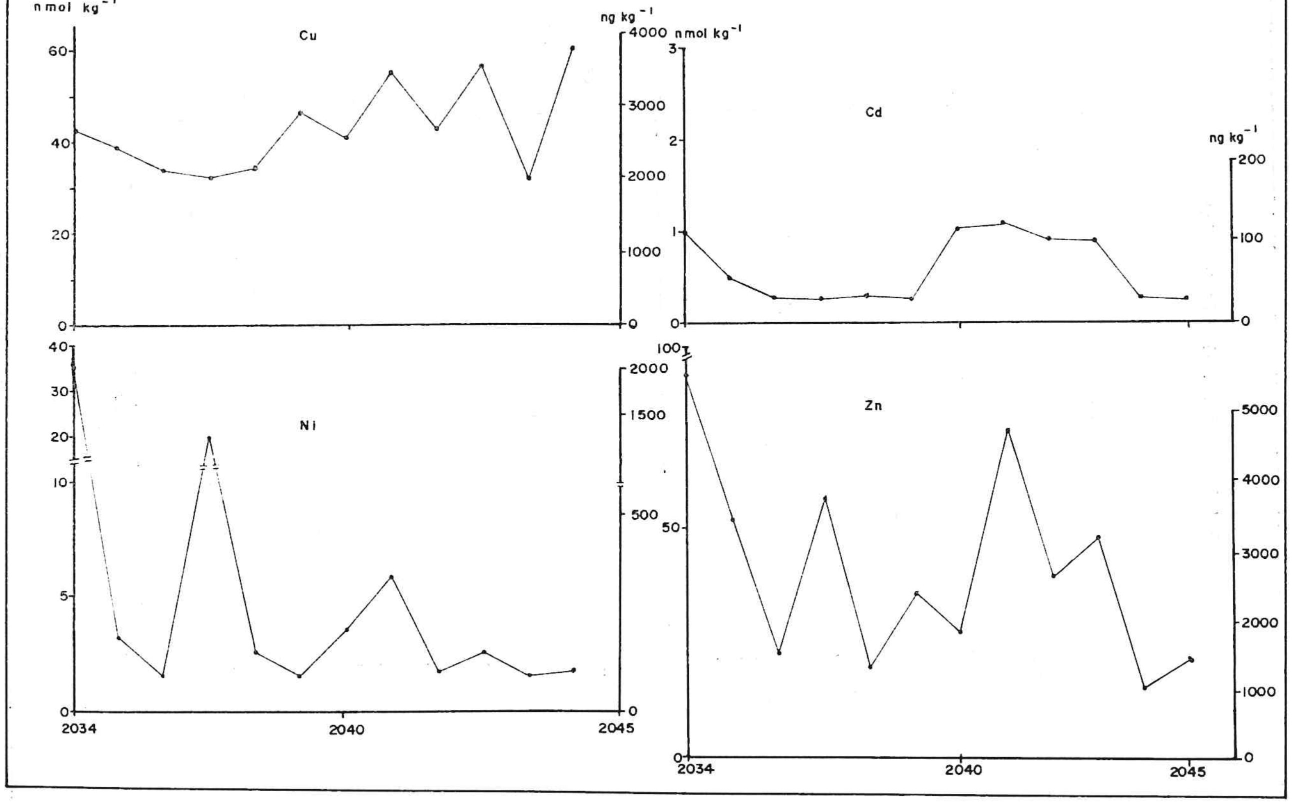


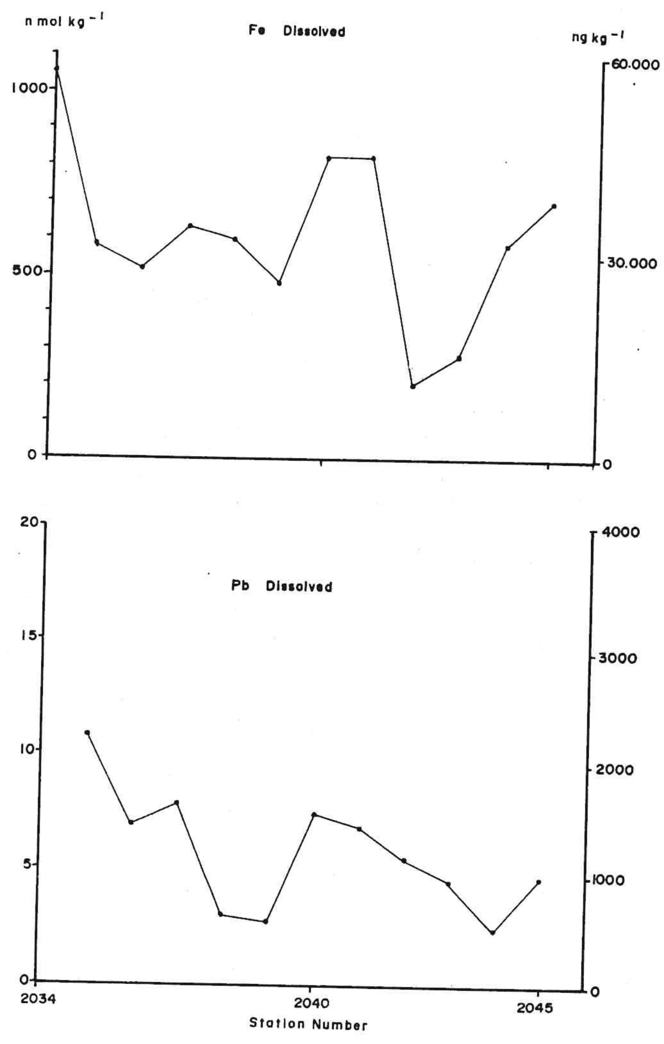
Fig 16, 17

Concentrations of dissolved Cu, Ni, Cd, Zn and Fe ($ng.kg^{-1}$ and $\mu mol.kg^{-1}$) in the river Porong. Anchor station, first and second period. Pb only in the second period.

ANCHOR STATION PORONG SECOND PERIOD (DISSOLVED)



ANCHOR STATION PORONG SECOND PERIOD



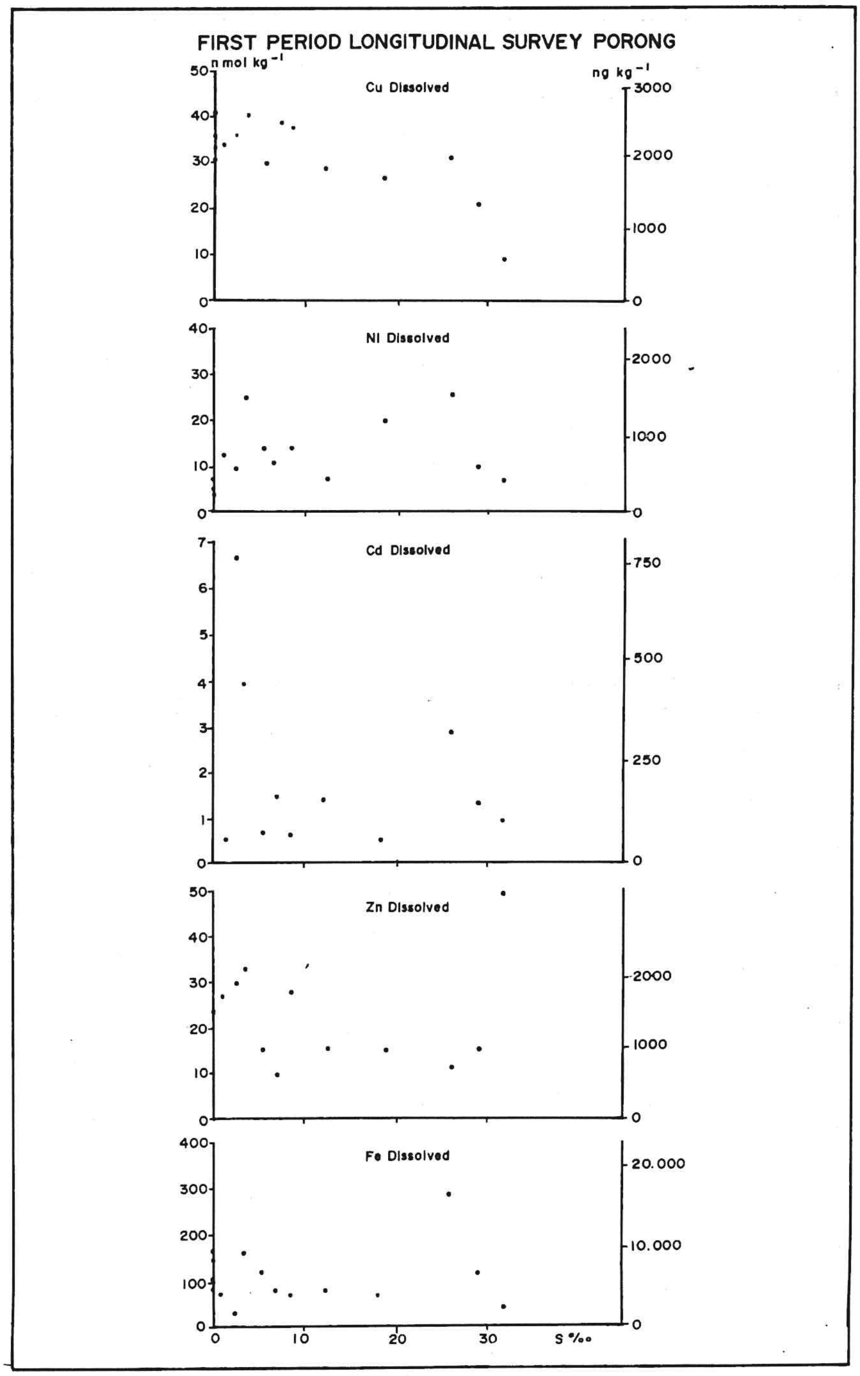


Fig 18

Concentrations of dissolved Cu, Ni, Cd, Zn and Fe, ($nmol.kg^{-1}$ and $ng.kg^{-1}$) against salinity in the longitudinal survey of the river Porong. First period.

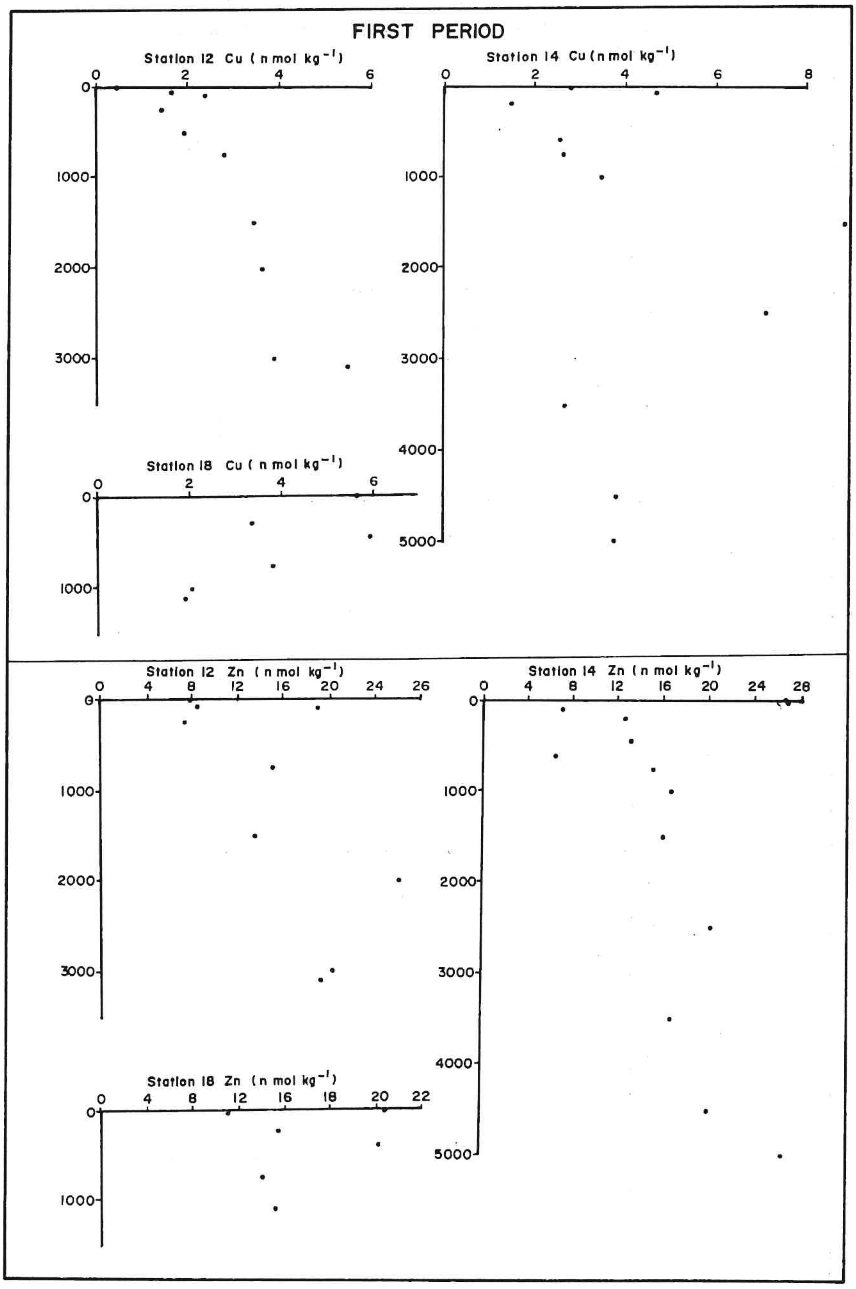
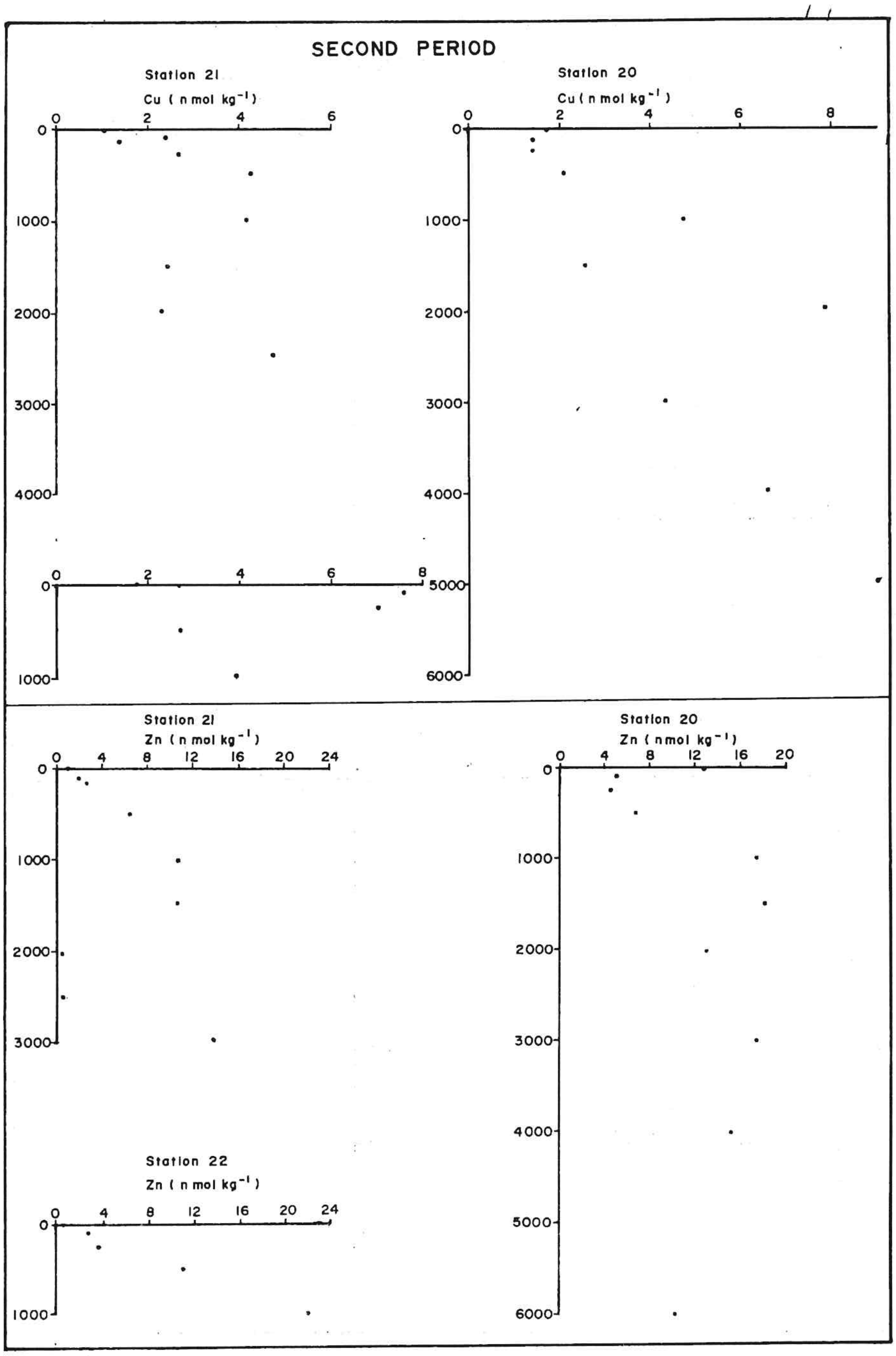


Fig 19

Dissolved Cu and Zn profiles at stations 12, 14, 18, 20, 21 and 22.



SECOND PERIOD
Station 21
Cu (n mol kg⁻¹)
Station 20
Cu (n mol kg⁻¹)
Station 21
Zn (n mol kg⁻¹)
Station 20
Zn (n mol kg⁻¹)
Station 22
Zn (n mol kg⁻¹)

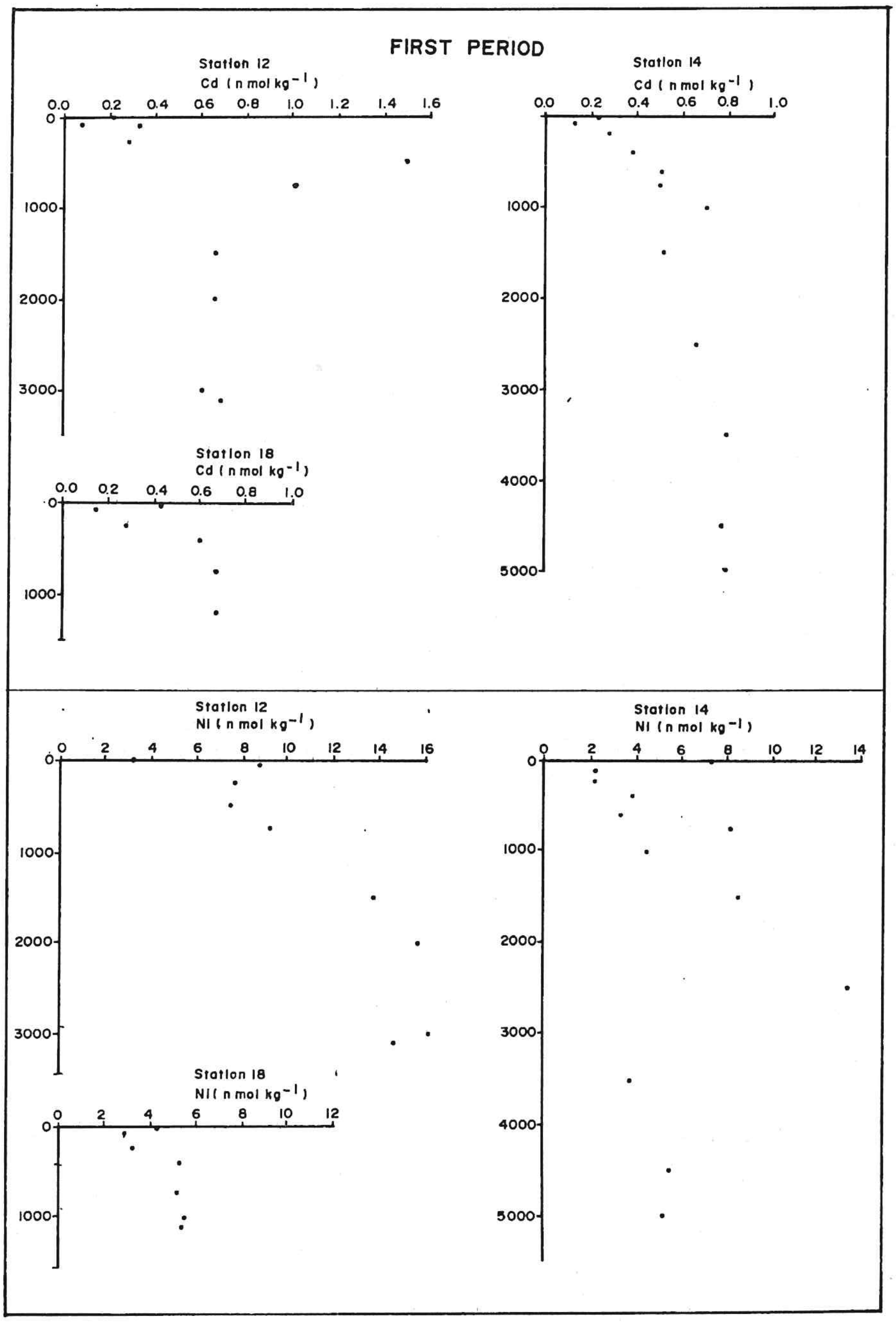
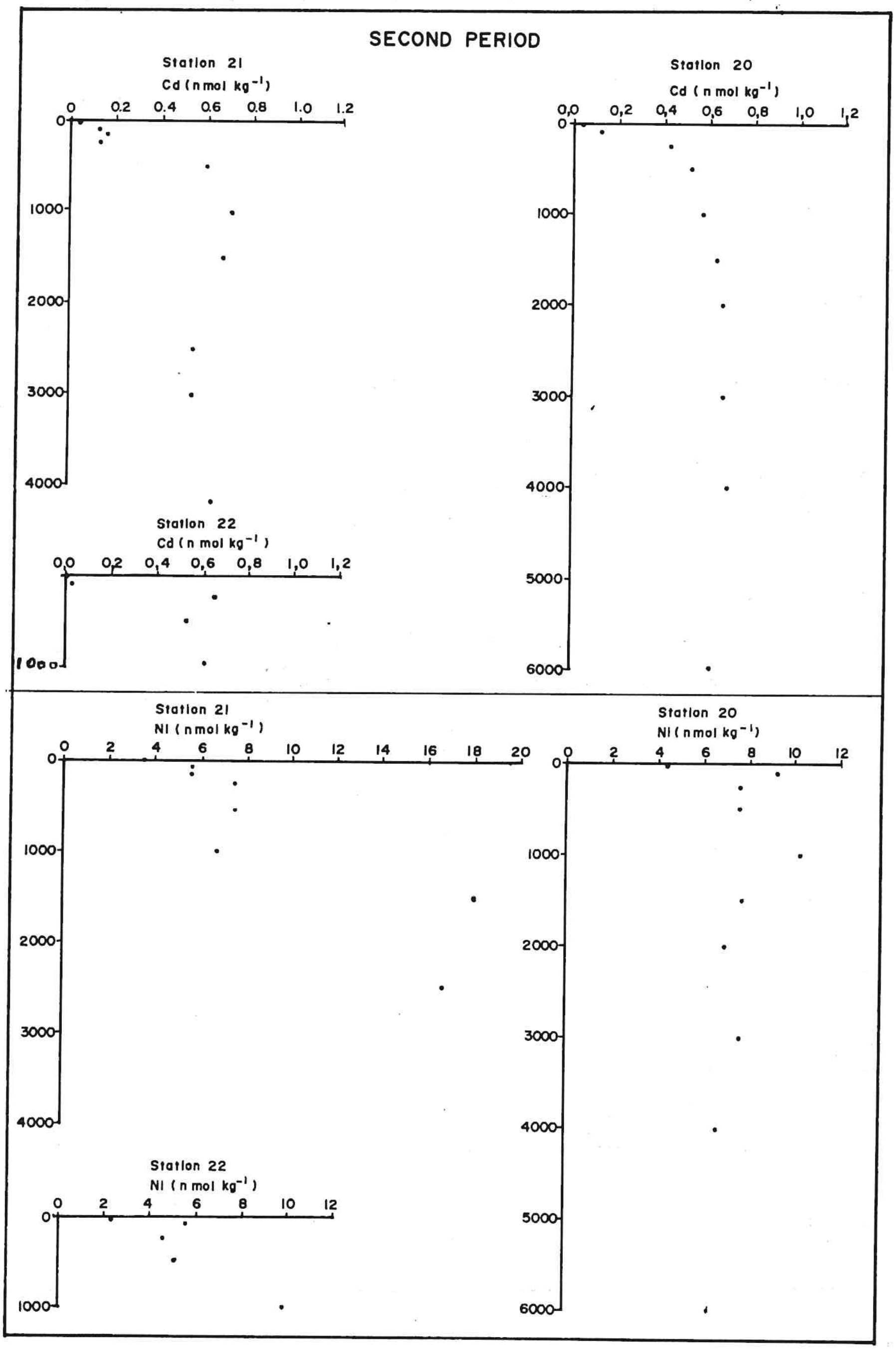


Fig 20

Dissolved Cd and Ni profiles at stations 12, 14, 18, 20, 21 and 22.


SECOND PERIOD
Station 21
Cd (n mol kg⁻¹)
Station 20
Cd (n mol kg⁻¹)
Station 22
Cd (n mol kg⁻¹)
Station 21
Ni (n mol kg⁻¹)
Station 20
Ni (n mol kg⁻¹)
Station 22
Ni (n mol kg⁻¹)

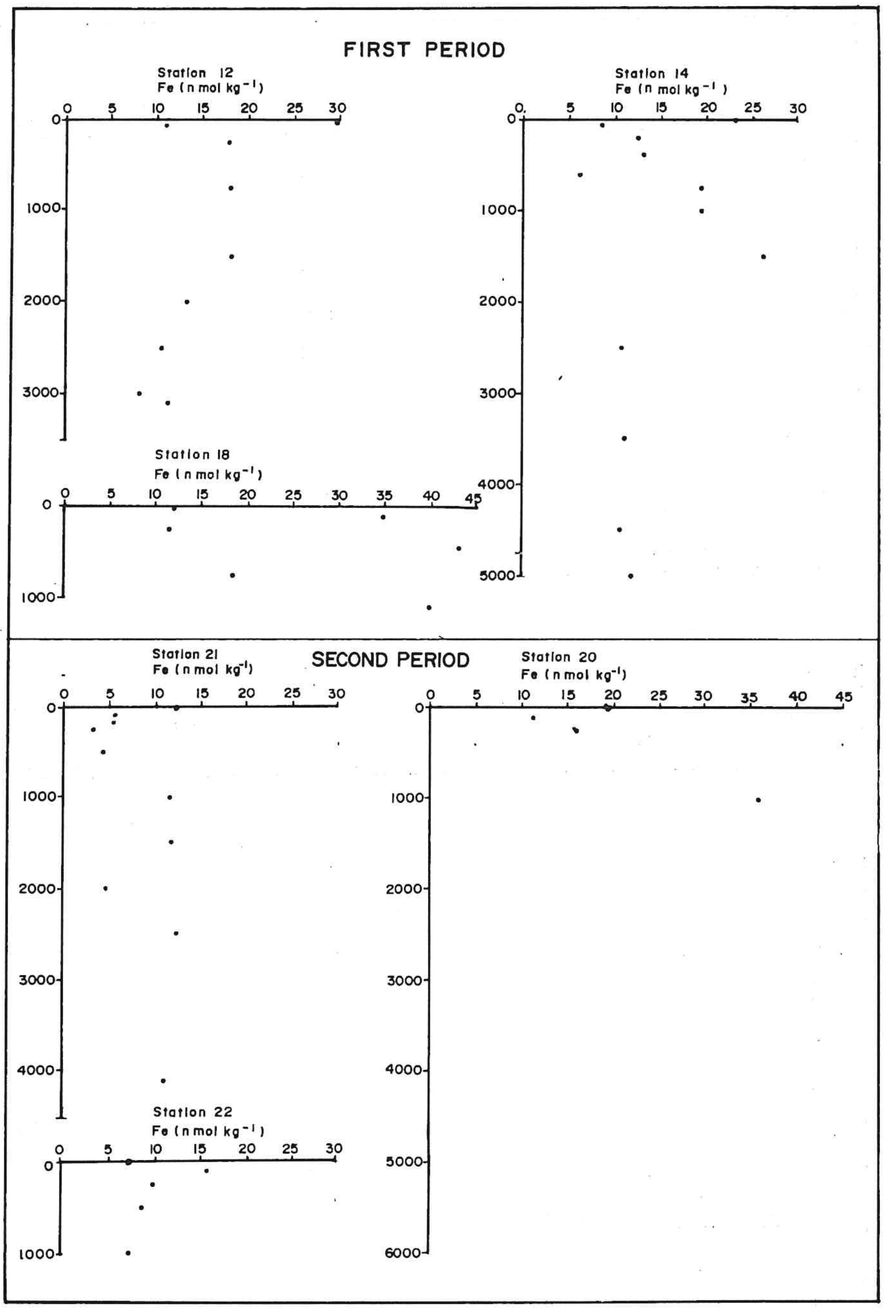


Fig 21

Dissolved Fe profile at stations 12, 14, 18, 20, 21 and 22.

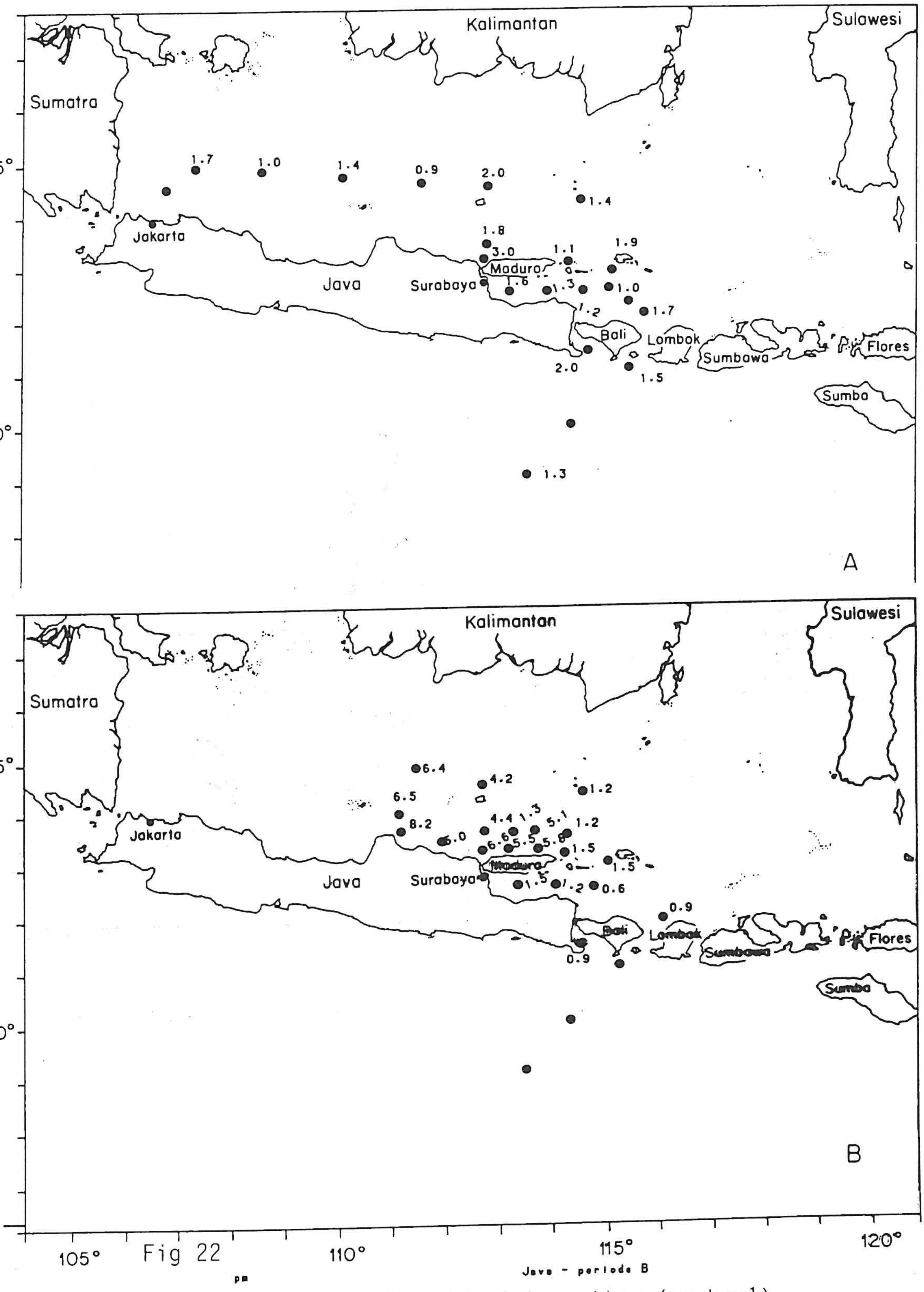
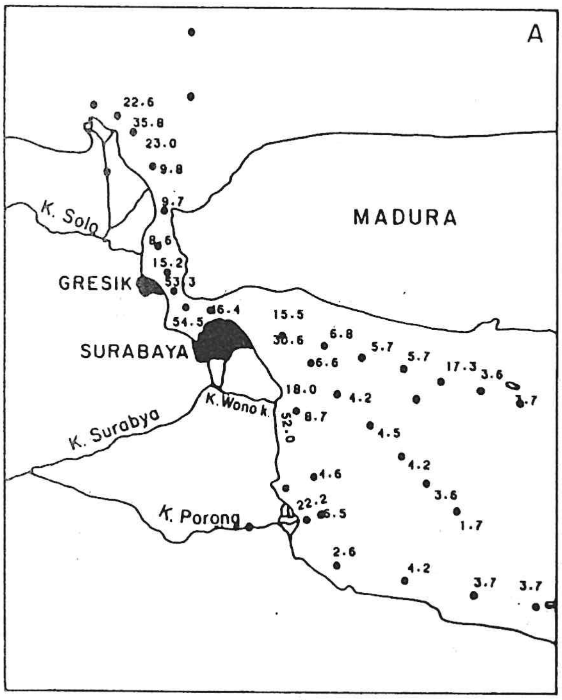
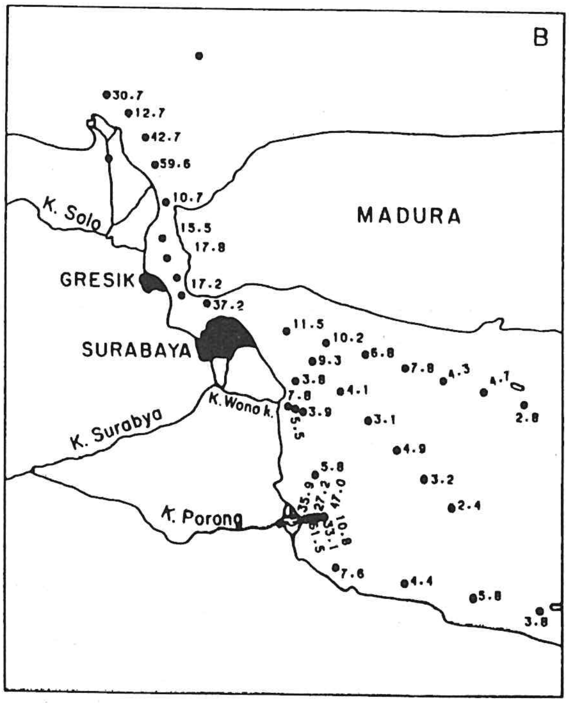


Fig 22

Amount of suspended particulate matter (mg.kg^{-1}).
A. First period. B. Second period.



ppm Madura - periode A



ppm Madura - periode B

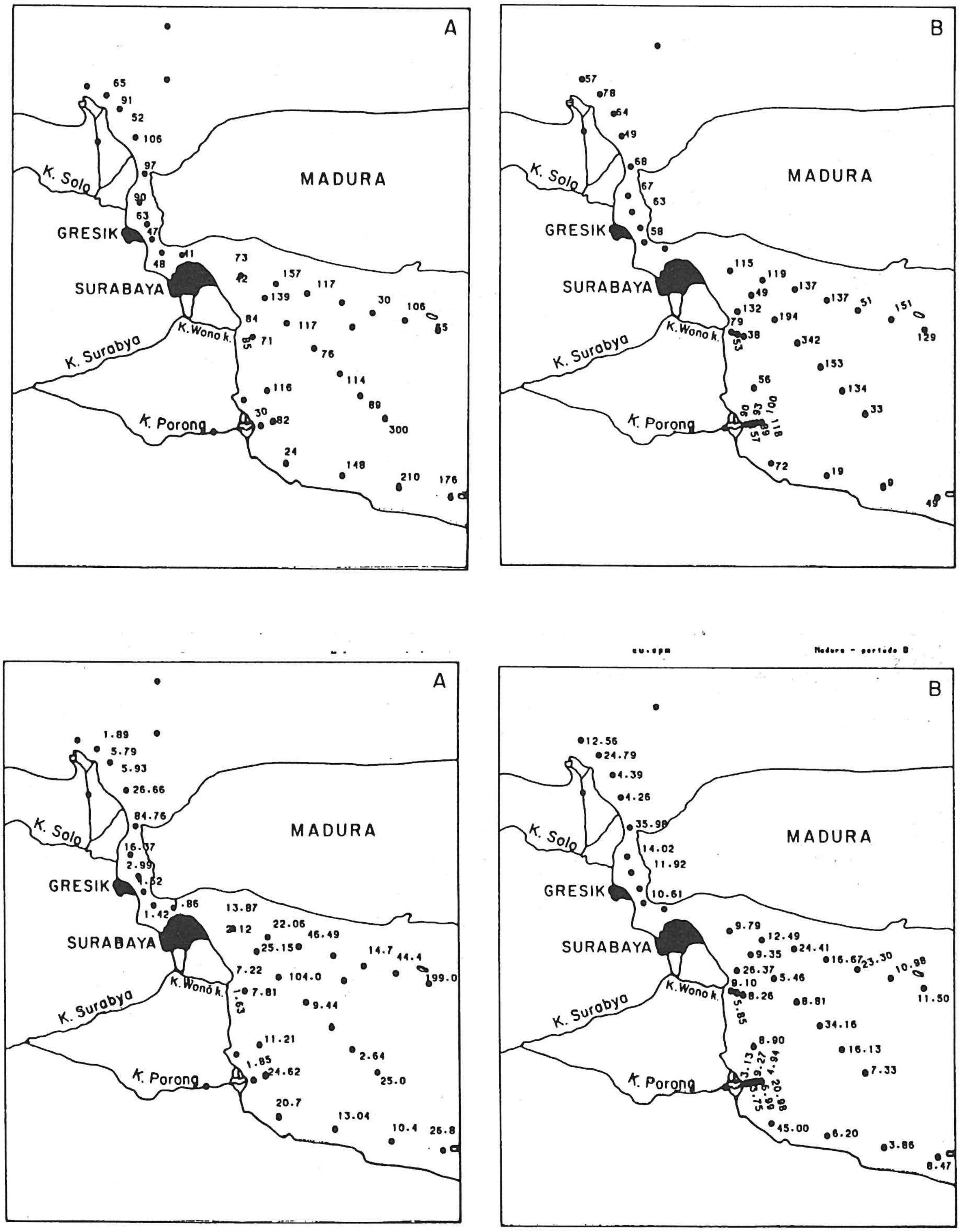
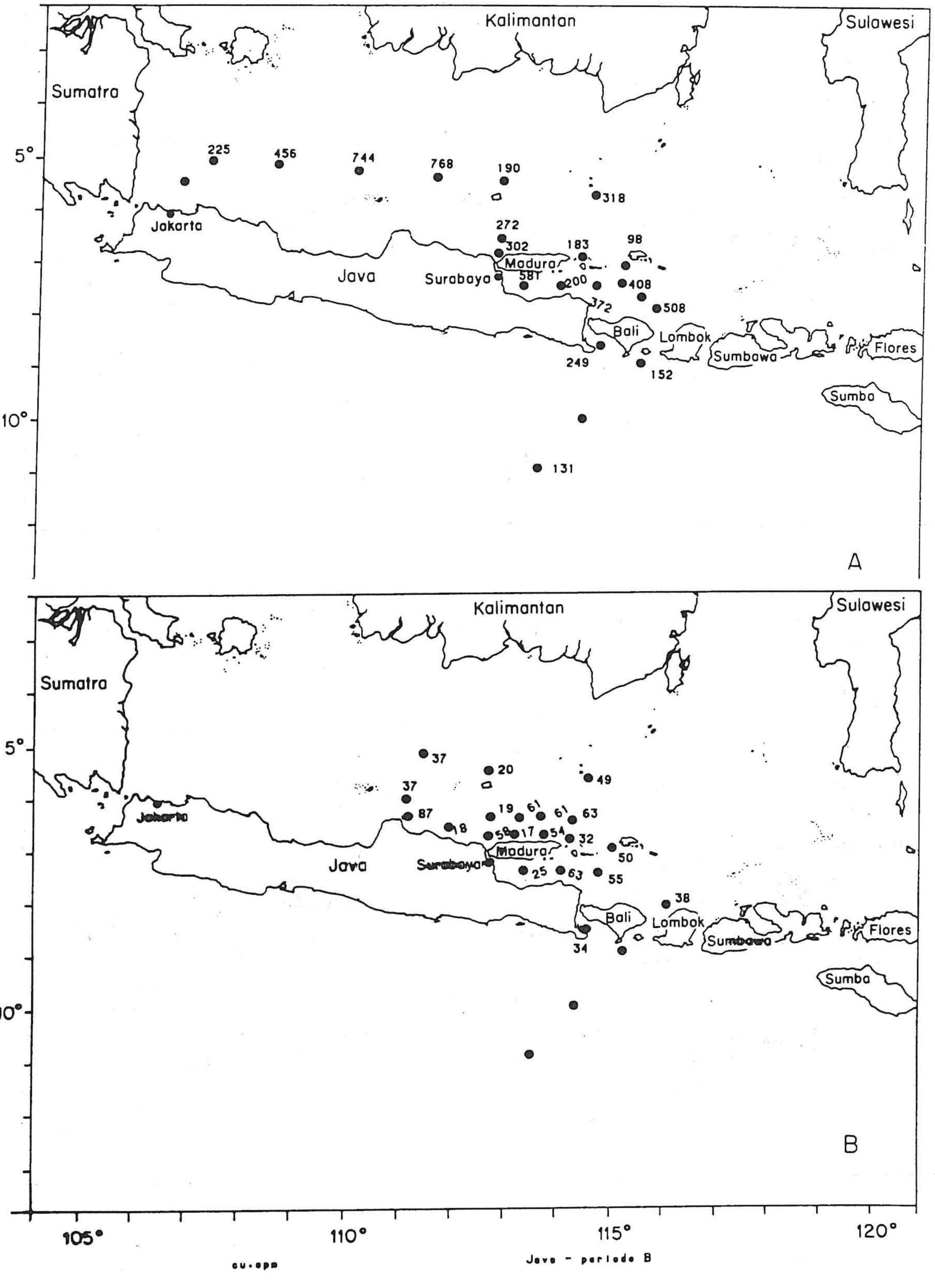


Fig 23

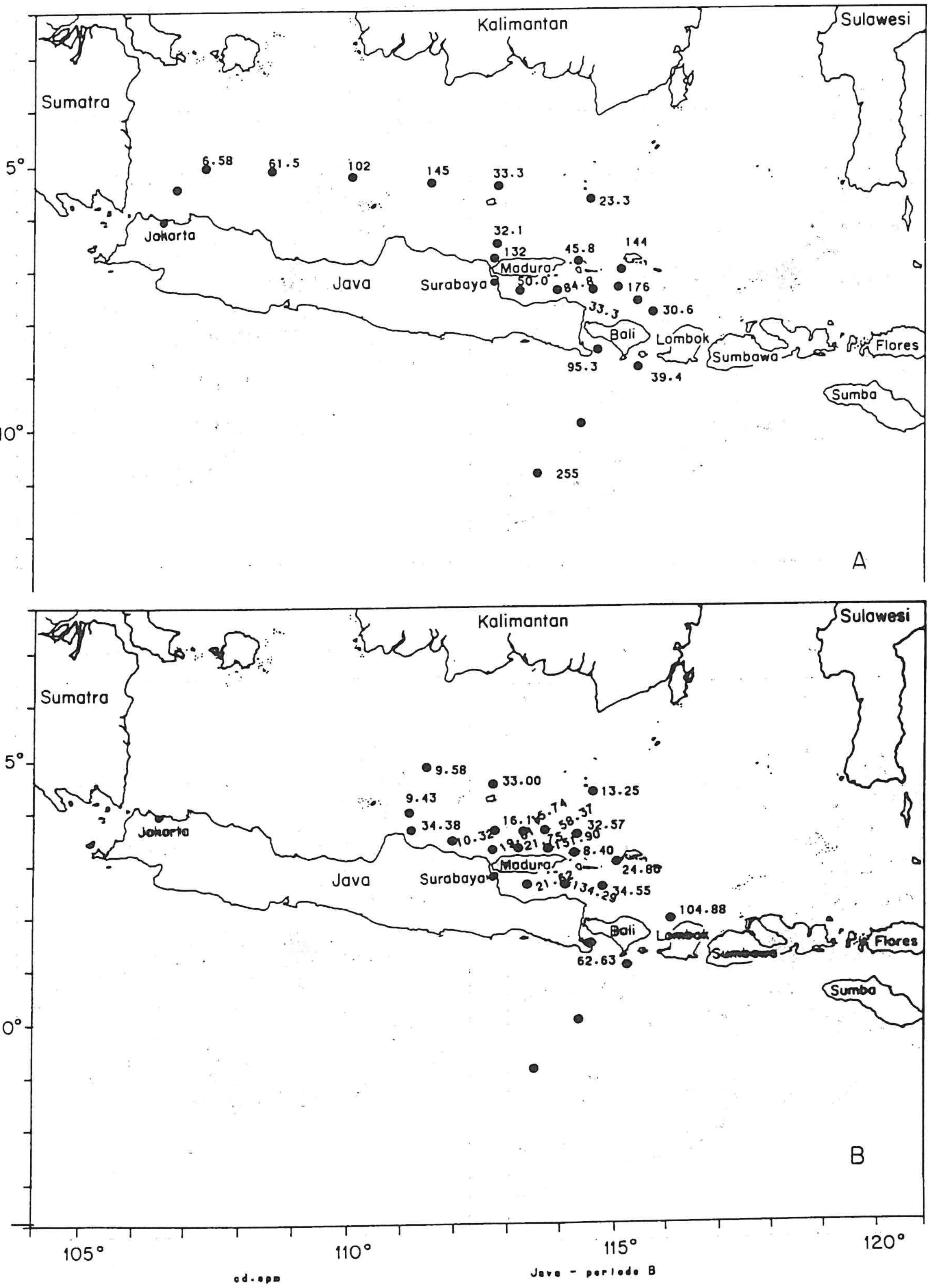
cd-ppm Madura - periode A cd-ppm Madura - periode B

Concentrations of Cu, Cd, Cr, Pb and Ni in the suspended matter fraction ($\mu g.g^{-1}$). A. First period. B. Second period.



cu.epm

Java - periode B


Kalimantan
Sulawesi
Sumatra
Jakarta
Java
Surabaya
Madura
Bali
Lombok
Sumbawa
Flores
Sumba
5°
10°
6.58
61.5
102
145
33.3
23.3
32.1
132
45.8
144
50.0
84.8
176
33.3
30.6
95.3
39.4
255
A
Kalimantan
Sulawesi
Sumatra
Jakarta
Java
Surabaya
Madura
Bali
Lombok
Sumbawa
Flores
Sumba
5°
10°
9.58
33.00
13.25
9.43
34.38
10.32
58.37
32.57
8.40
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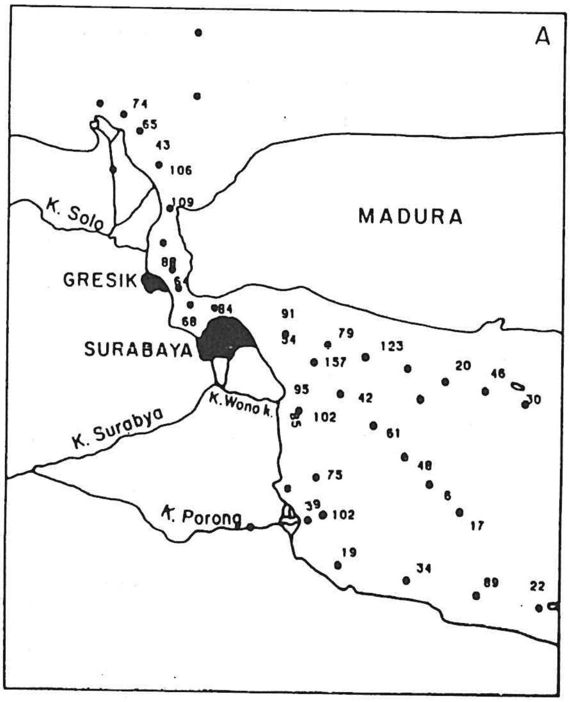
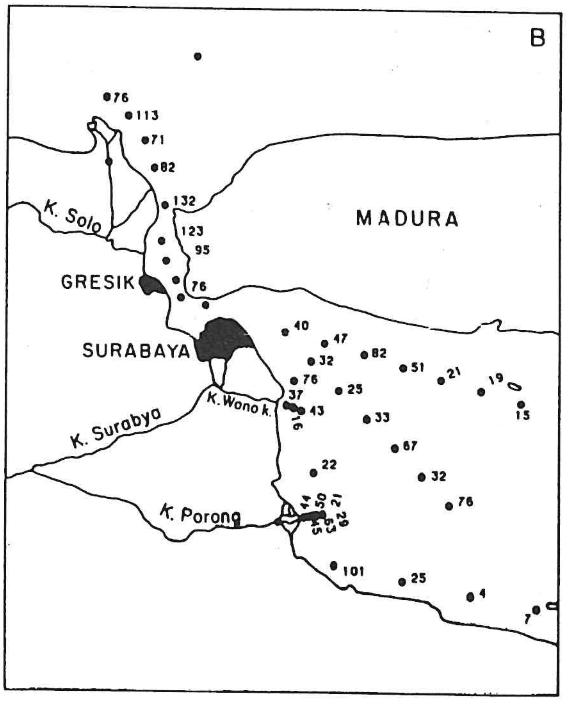
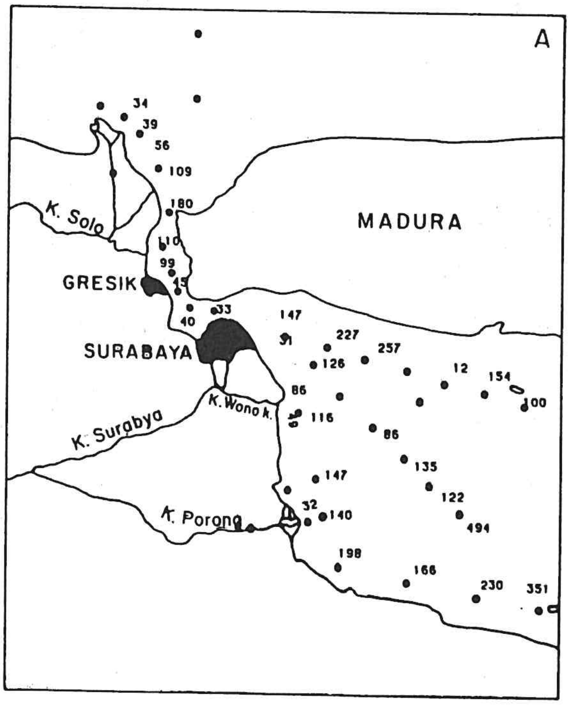
34.55
104.88
62.63
B
105°
110°
115°
120°
od.epm
Java - periode B

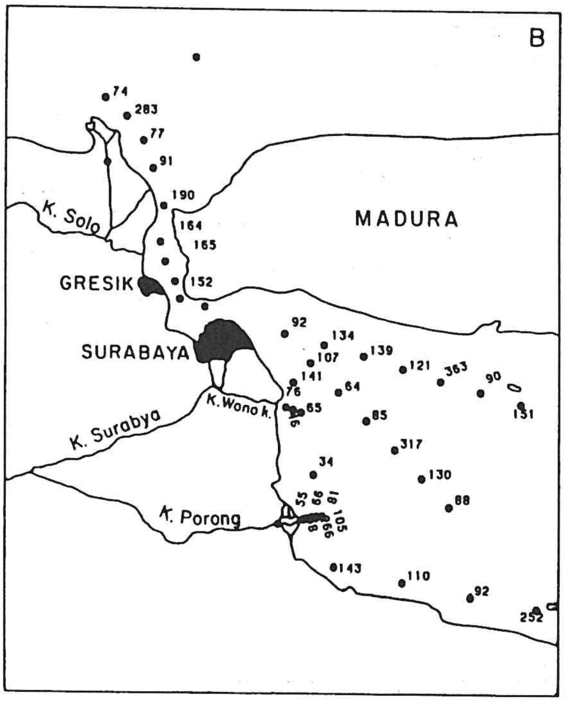




cr.ppm Madura - periode A

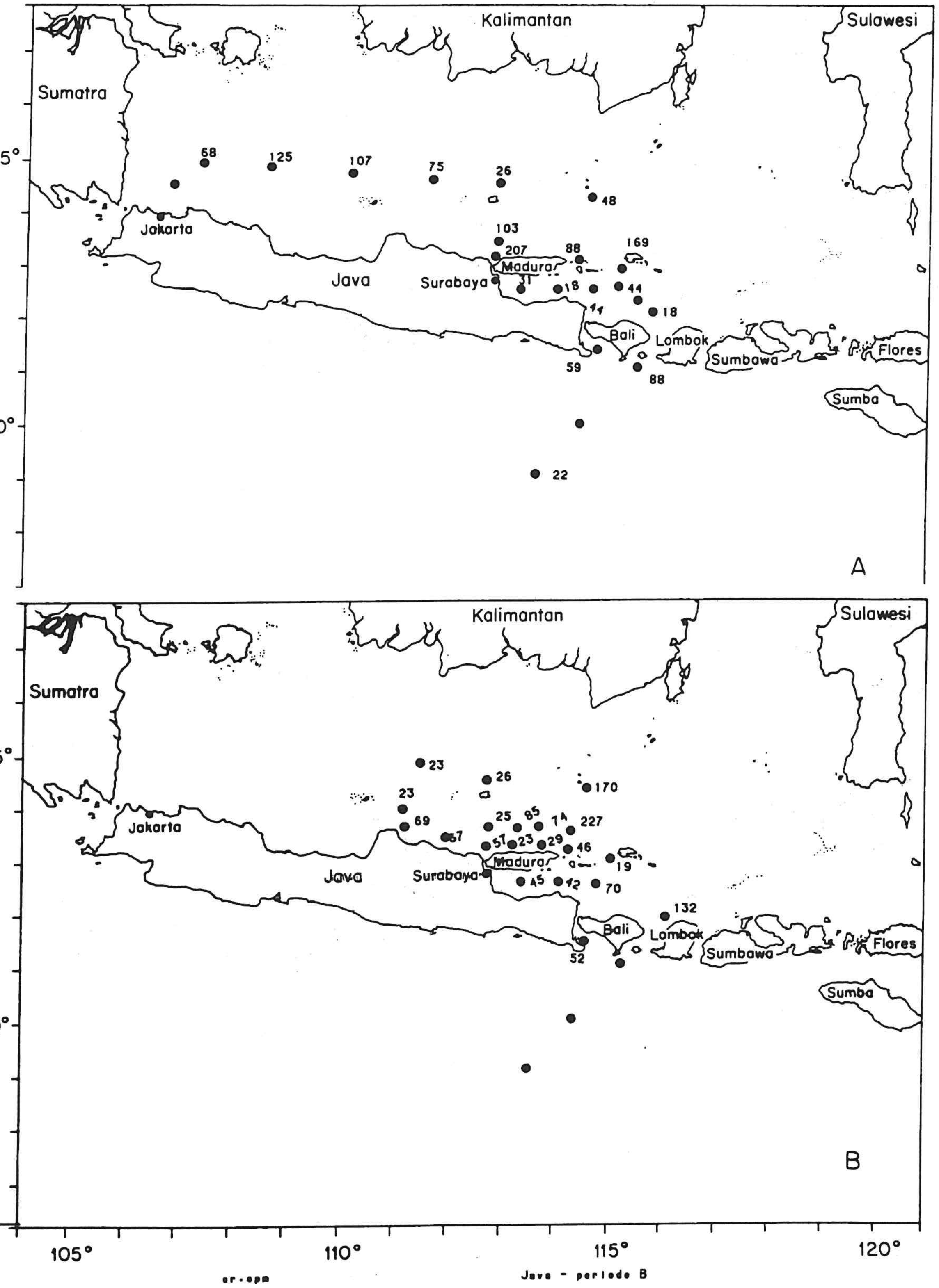
cr.ppm Madura - periode B





pb.ppm Madura - periode A

pb.ppm Madura - periode B


Kalimantan
Sulawesi
Sumatra
Jakarta
Java
Madura
Surabaya
Bali
Lombok
Sumbawa
Flores
Sumba
5°
10°
68
125
107
75
26
48
103
207
88
169
31
18
44
18
59
88
22
A
23
26
170
23
69
25
85
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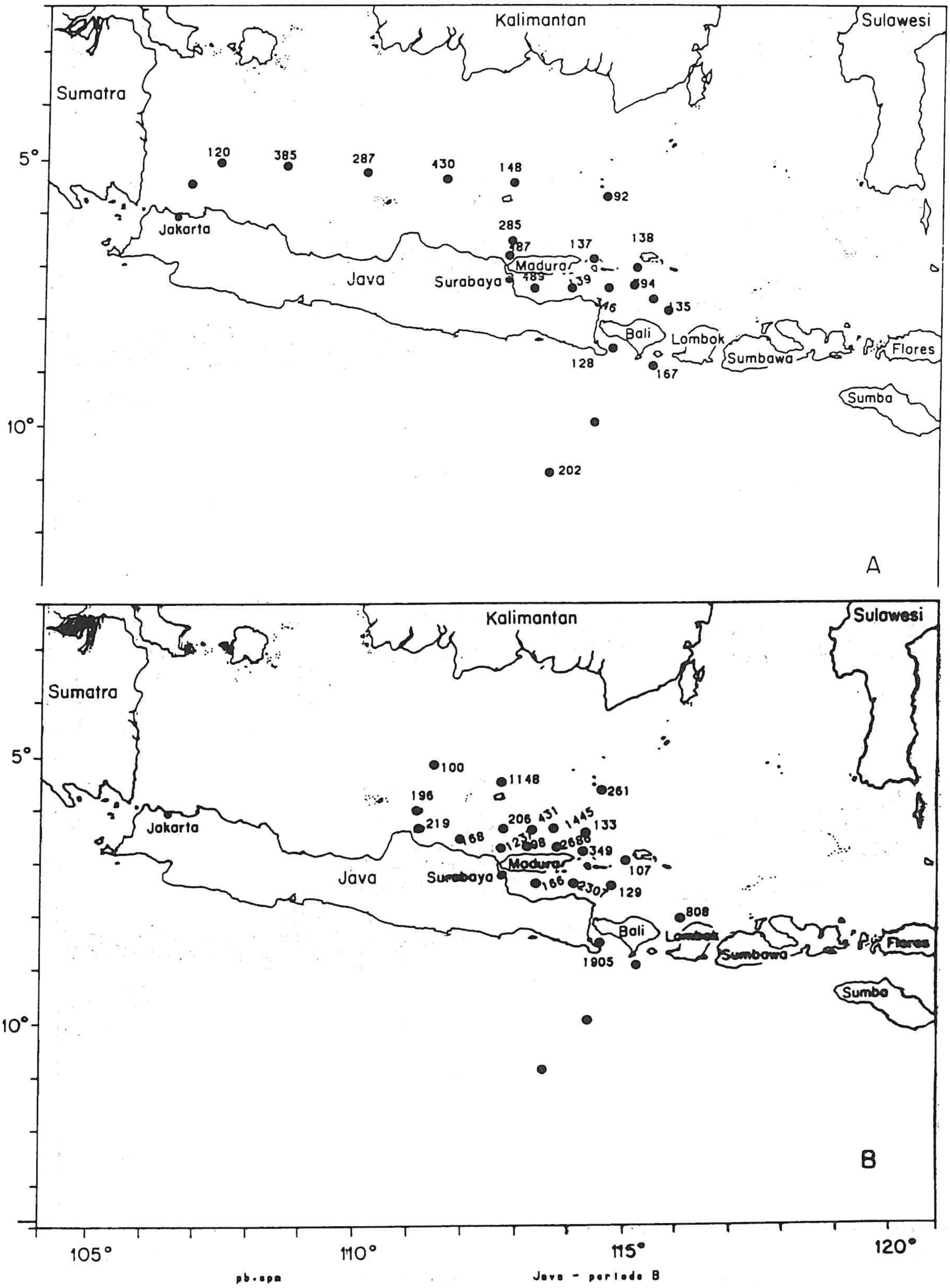
46
19
45
42
70
132
52
B
105°
110°
115°
120°
Java - periode B



Kalimantan
Sulawesi
Sumatra
Jakarta
Java
Surabaya
Madura
Bali
Lombok
Sumbawa
Flores
Sumba
5°
10°
120
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287
430
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92
285
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138
489
139
135
128
167
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100
1148
261
196
219
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B
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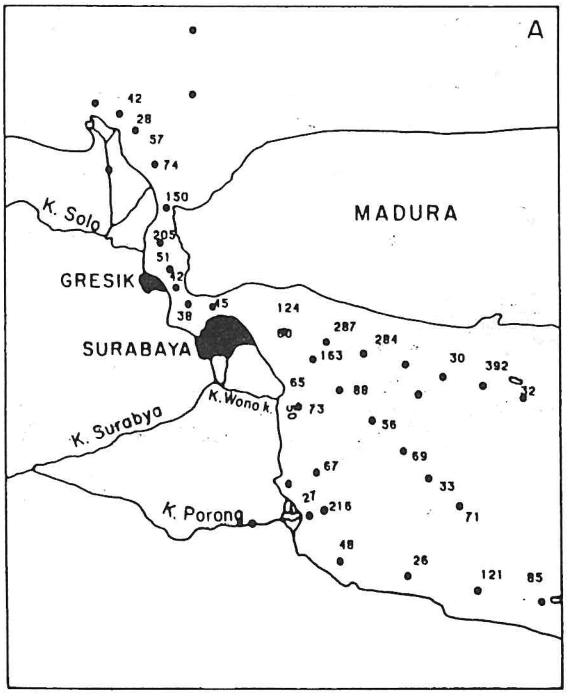
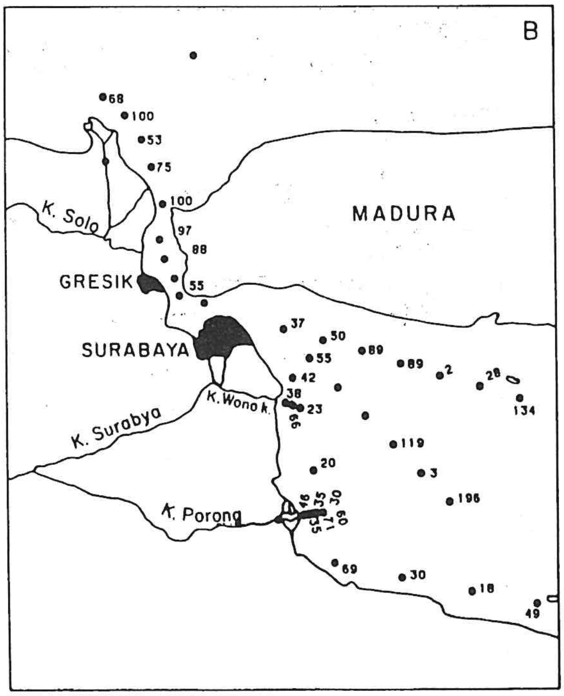
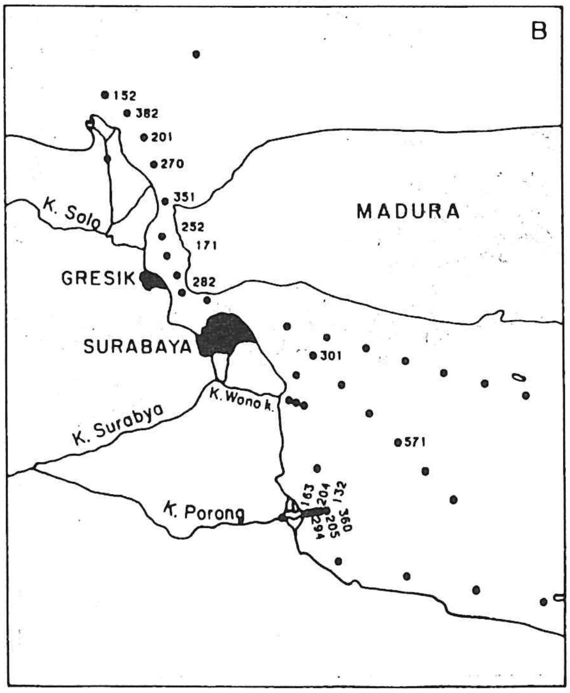
110°
115°
120°
pb.epm
Java - periode B



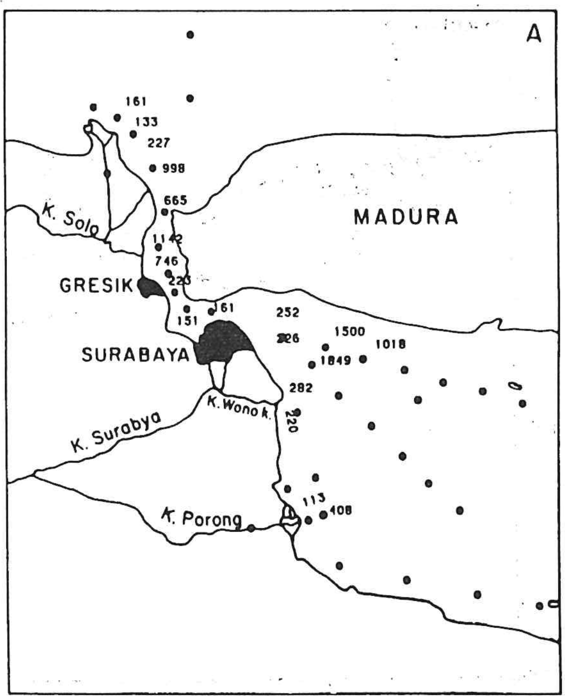
ni.ppm Madura - periode A



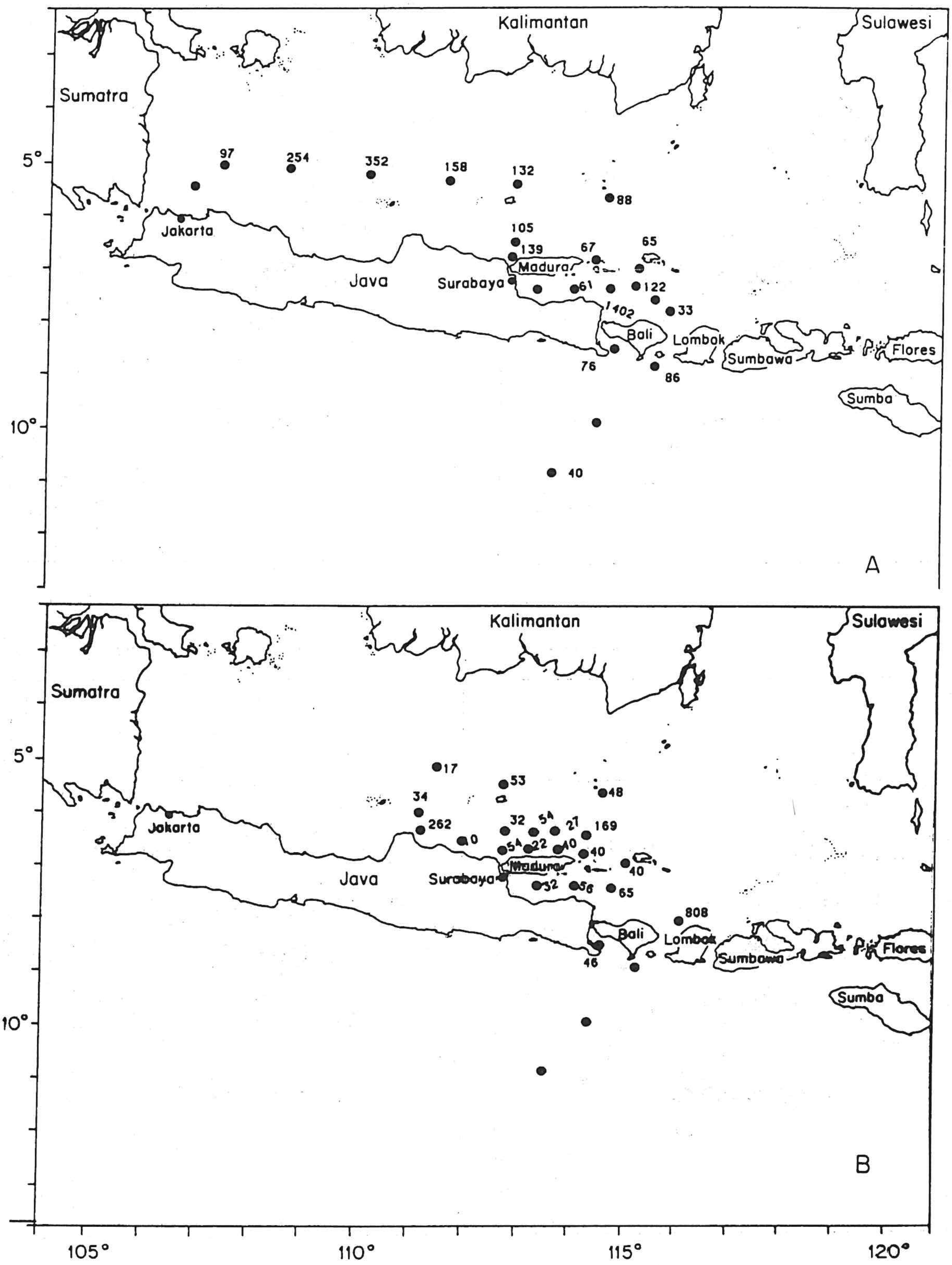
ni.ppm Madura - periode B



zn.ppm Madura - periode B



zn.ppm Madura - periode A



Kalimantan
Sulawesi
Sumatra
5°
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Jakarta
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Madura
Java
Surabaya
61
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Bali
Lombok
Sumbawa
Flores
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Sumba
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Kalimantan
Sulawesi
Sumatra
5°
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Java
Surabaya
32
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Bali
Lombok
Sumbawa
Flores
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10°
B
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110°
115°
120°
nl.spm
Java - periode B

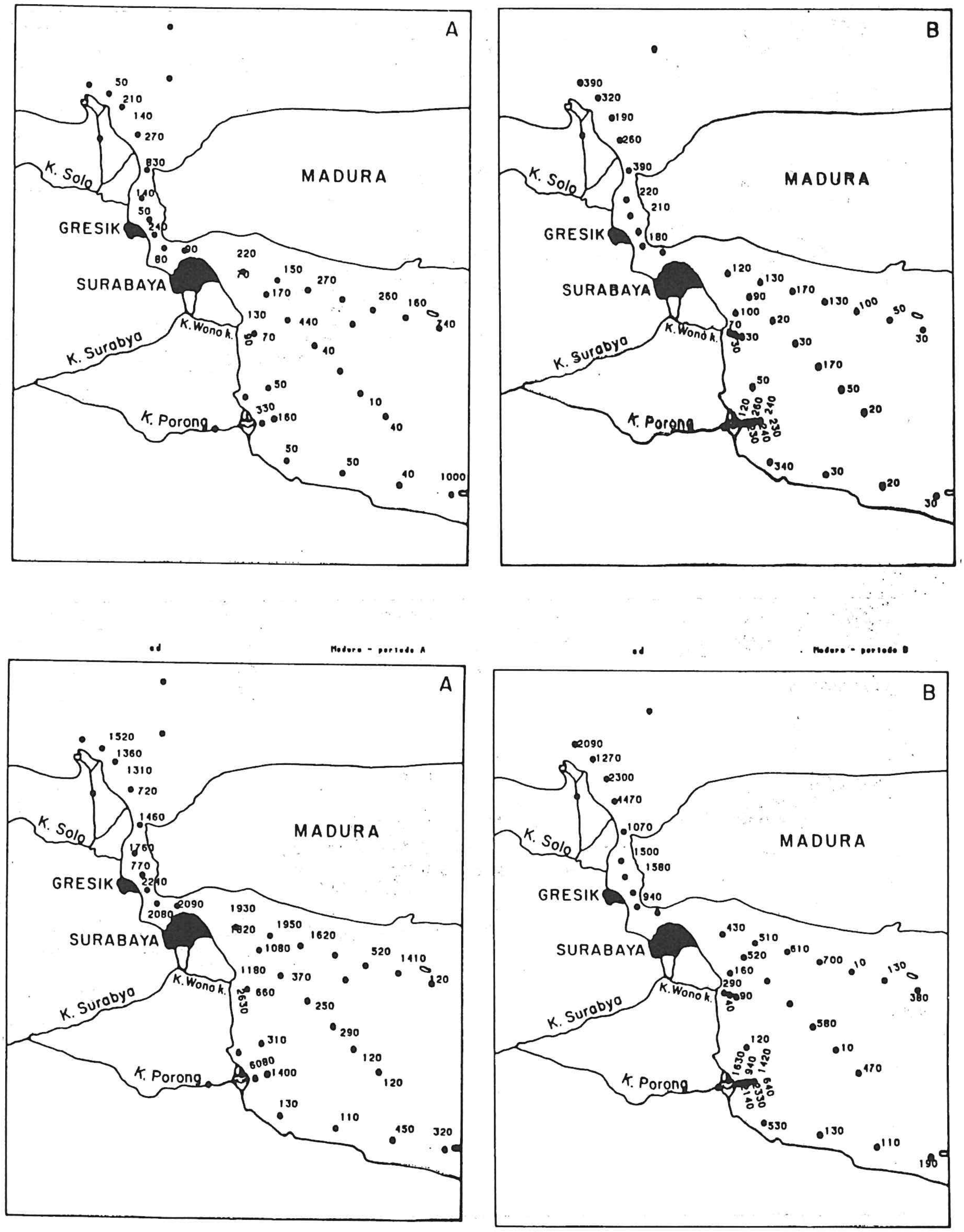
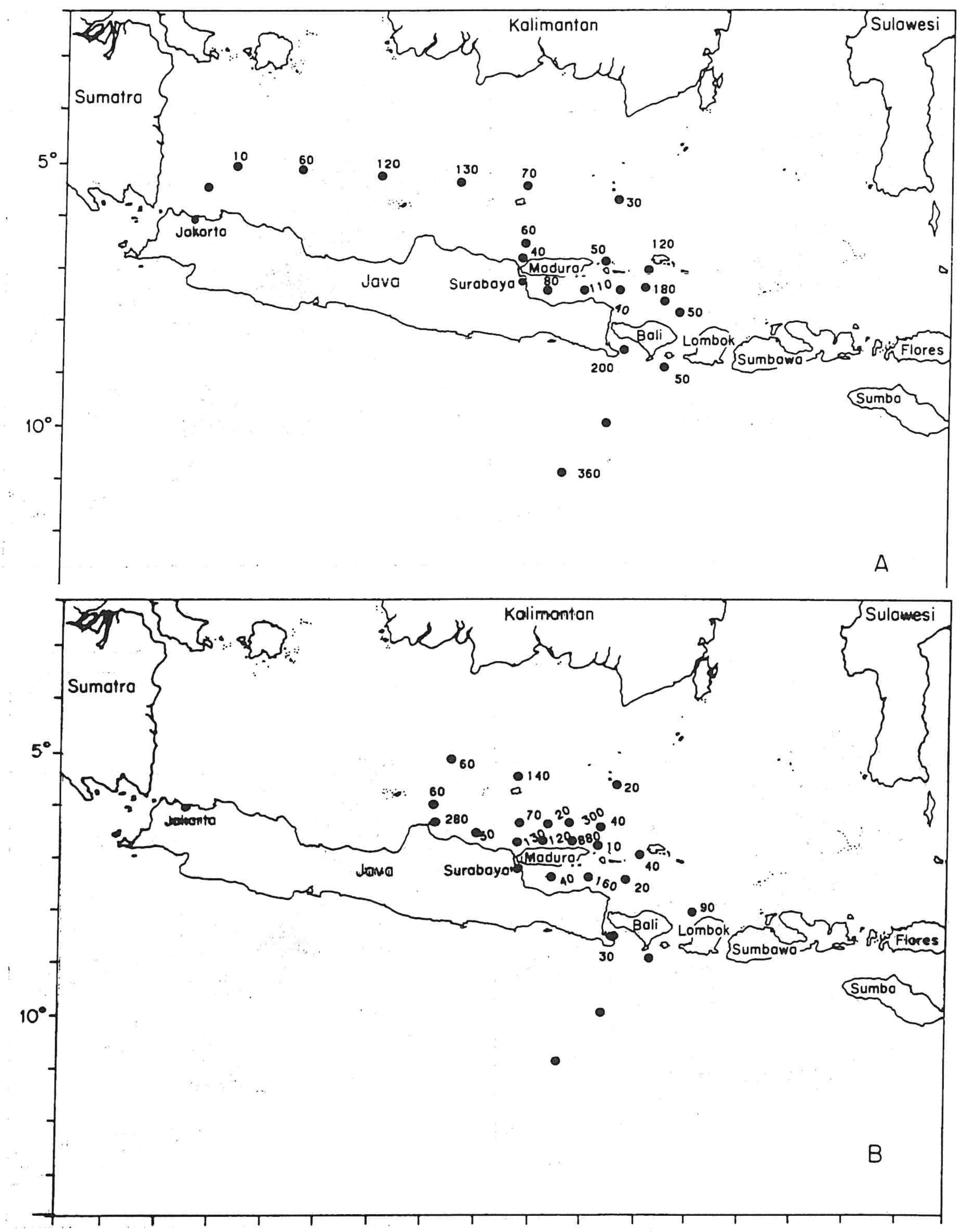


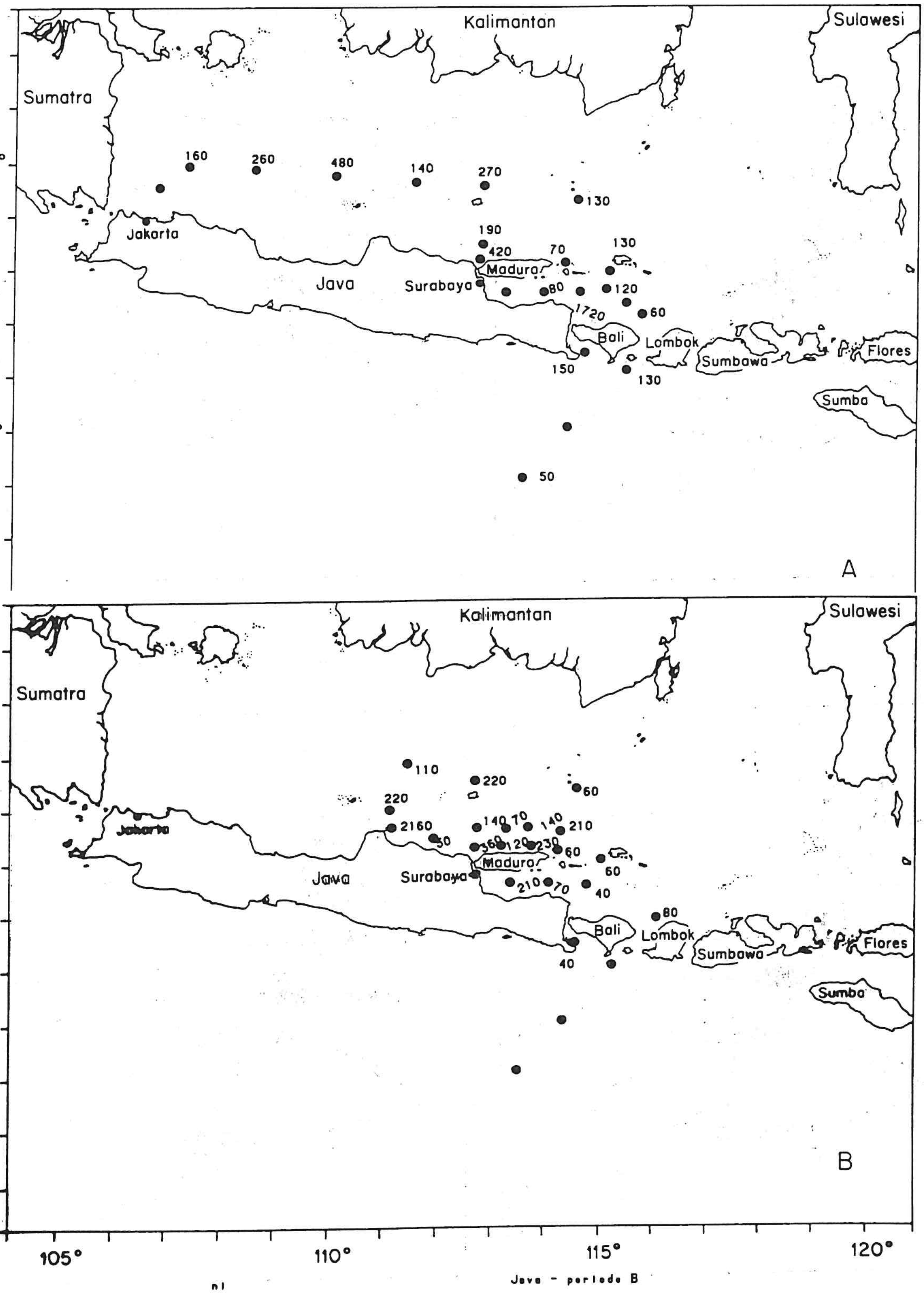
Fig 23 A

Concentrations of Cd, Ni, Pb, Cr, Zn and Cu in the suspended matter fraction (ng.kg^{-1}). A. First period. B. Second period.



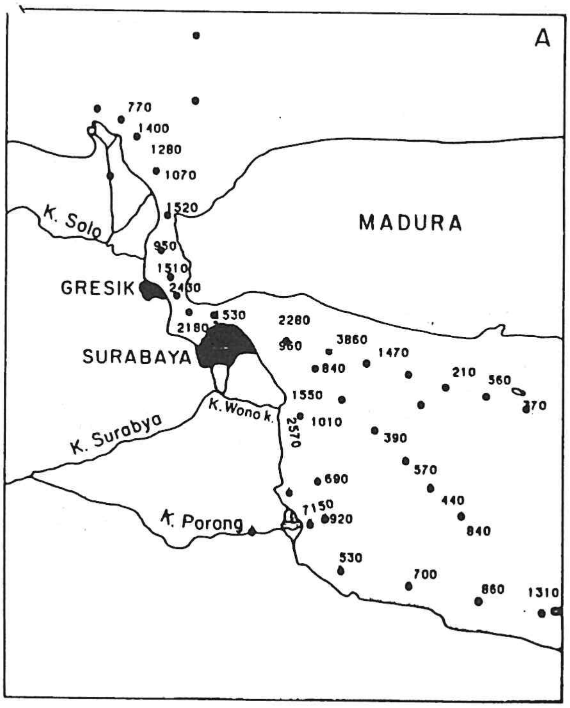
od

Java - periode B

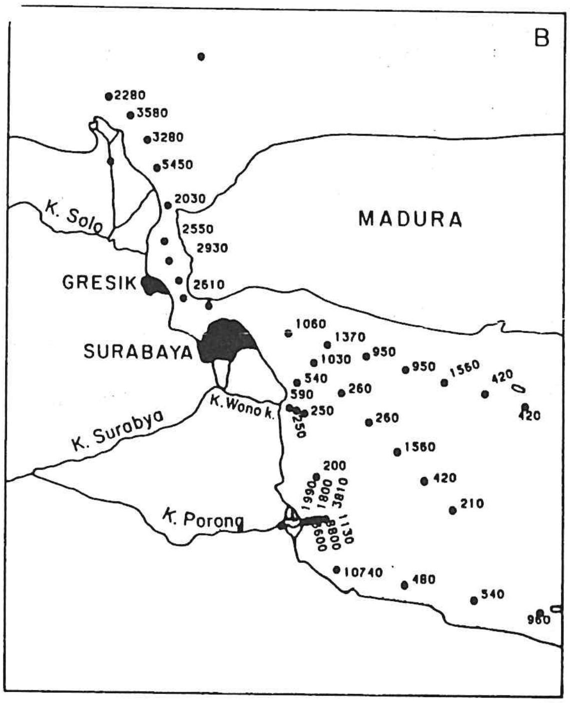


nl

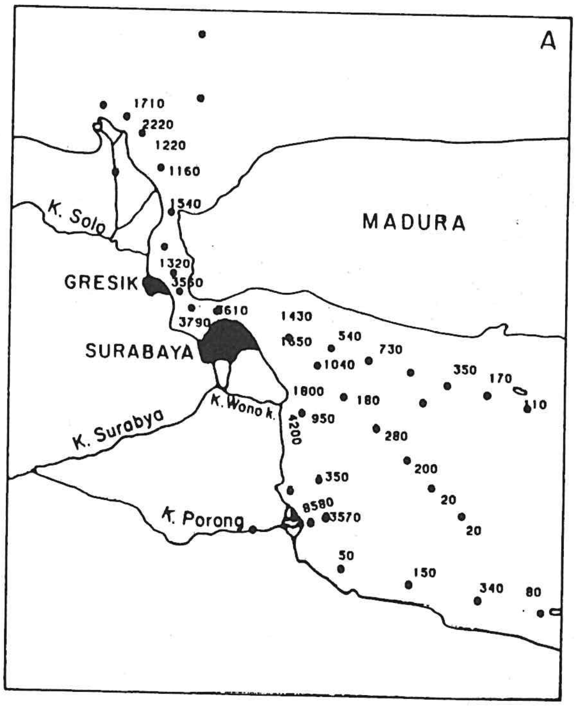
Java - periode B



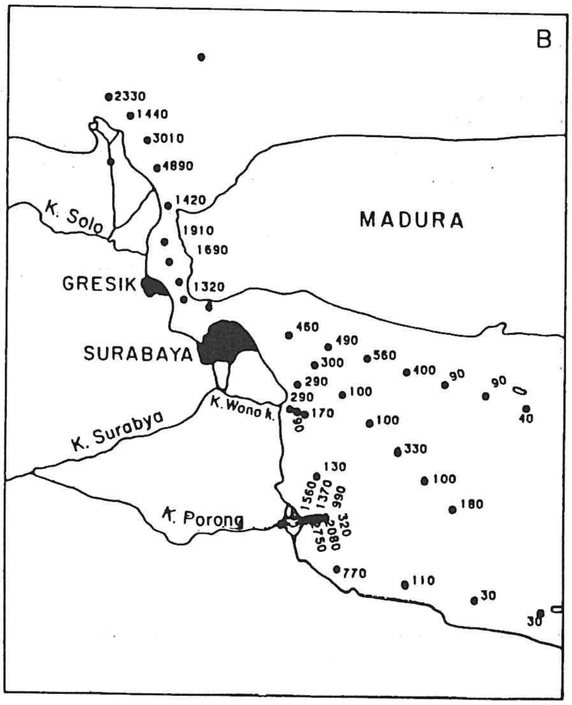
b Madura - periode A



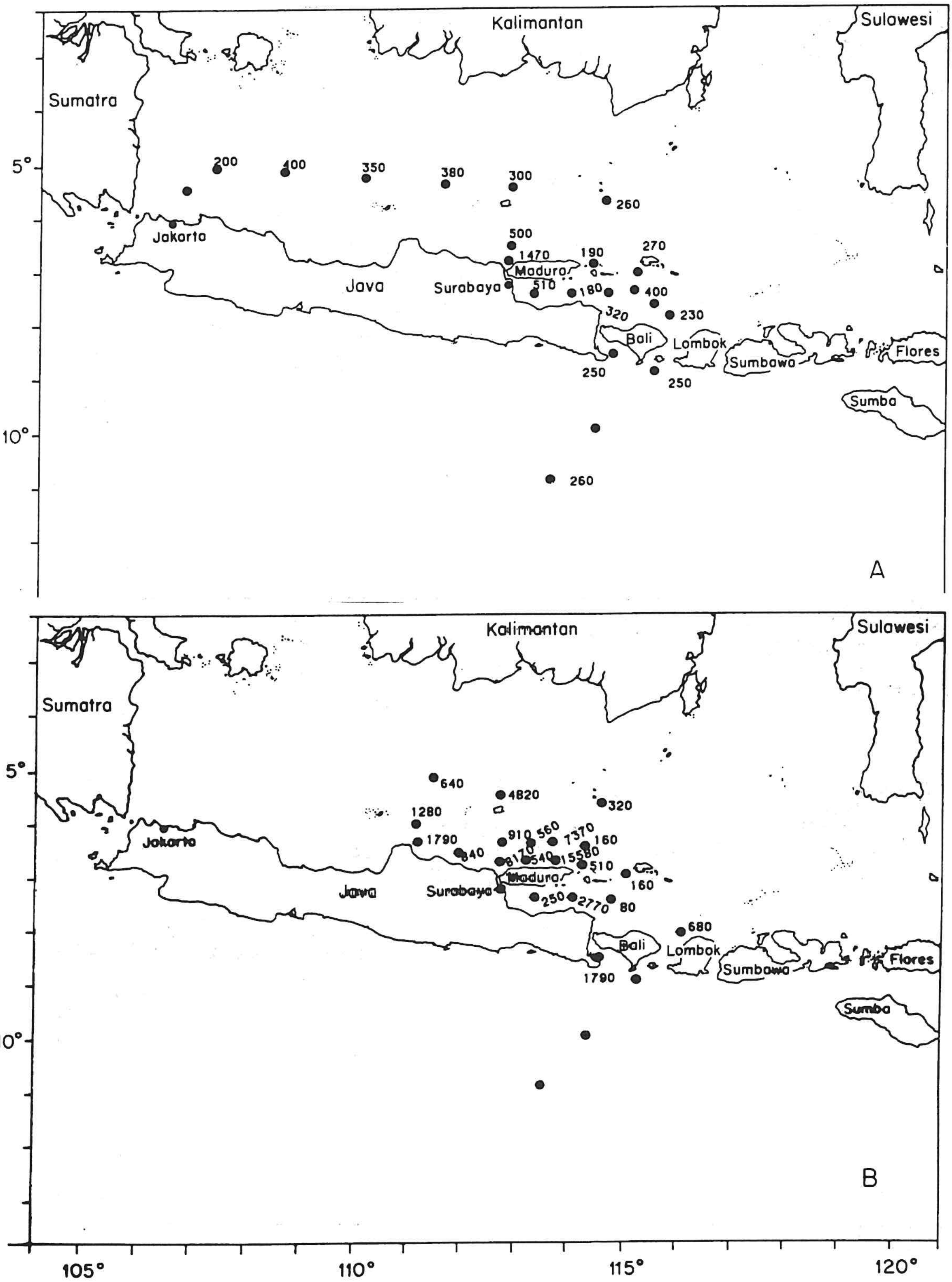
pb Madura - periode B



cr Madura - periode A

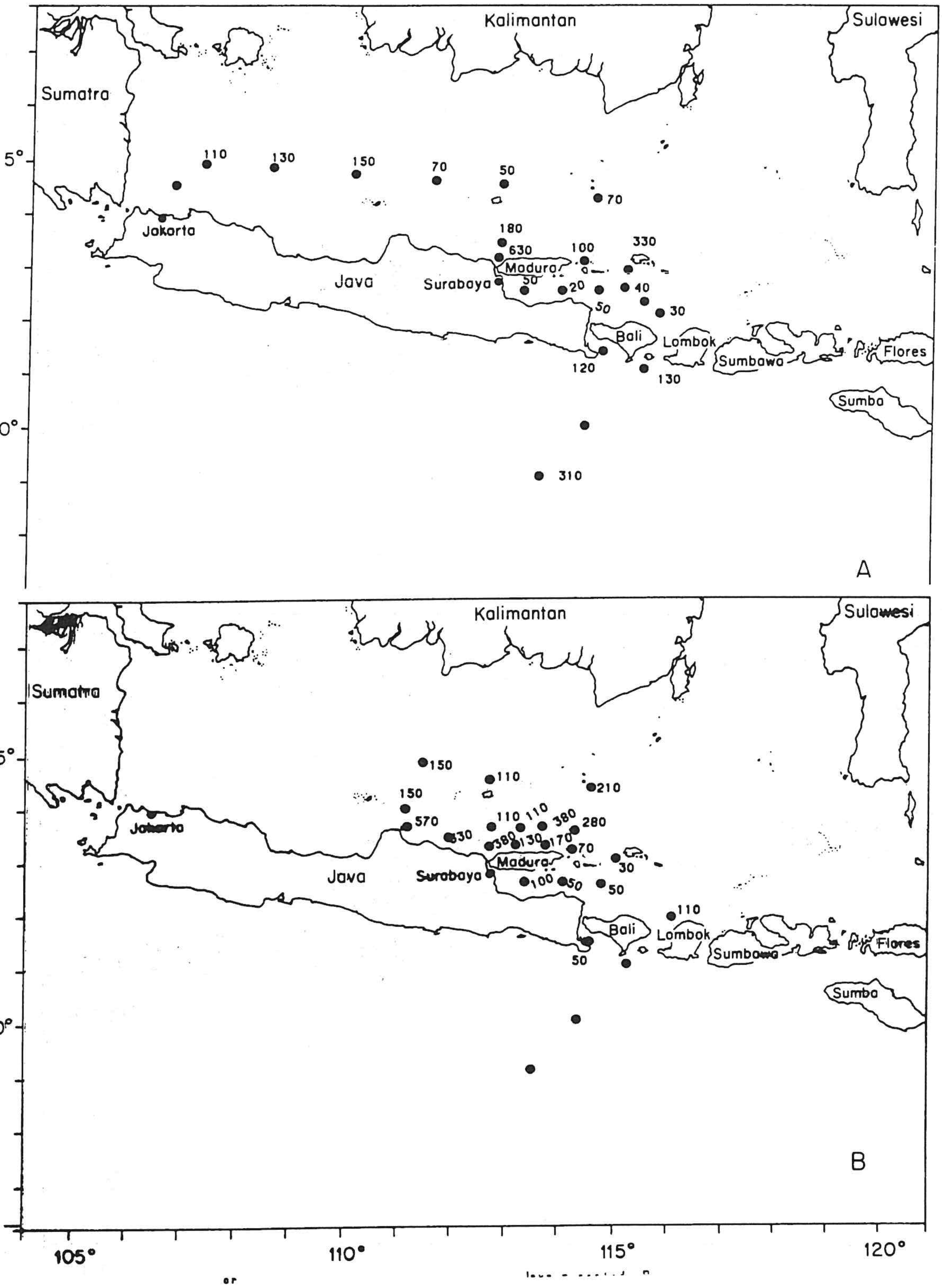


cr Madura - periode B



pb

Java - periode B


Kalimantan
Sulawesi
Sumatra
Jakarta
Java
Surabaya
Madura
Bali
Lombok
Sumbawa
Flores
Sumba
5°
10°
110
130
150
70
50
70
180
630
100
330
50
20
40
50
30
120
130
310
A
150
110
210
150
570
110
110
380
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630
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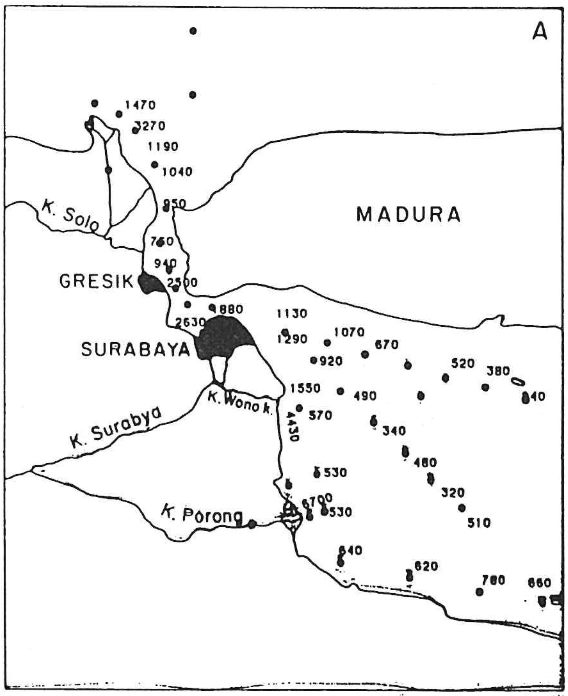
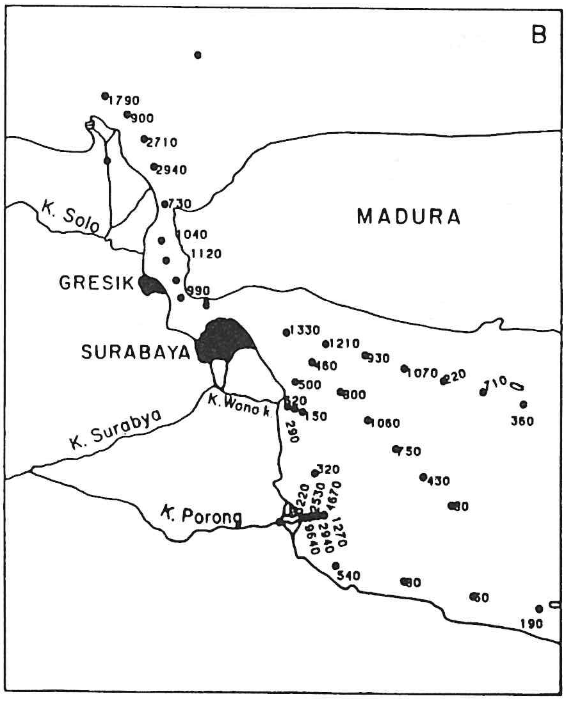
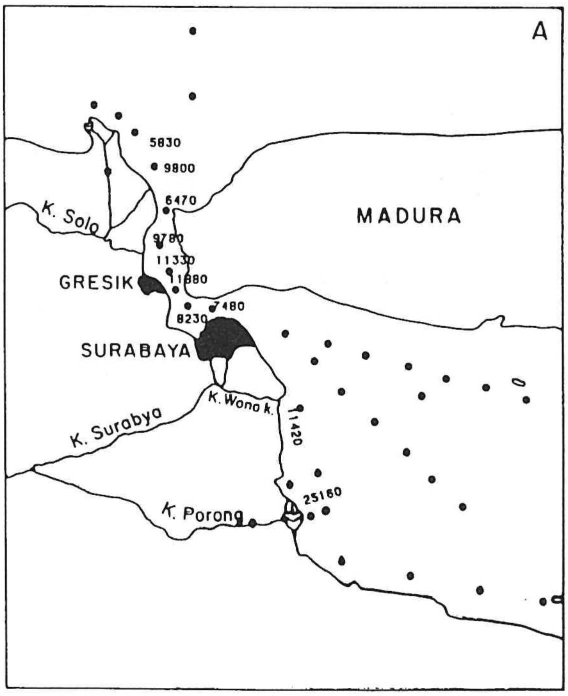
130
170
70
30
100
50
50
110
50
B
105°
110°
115°
120°



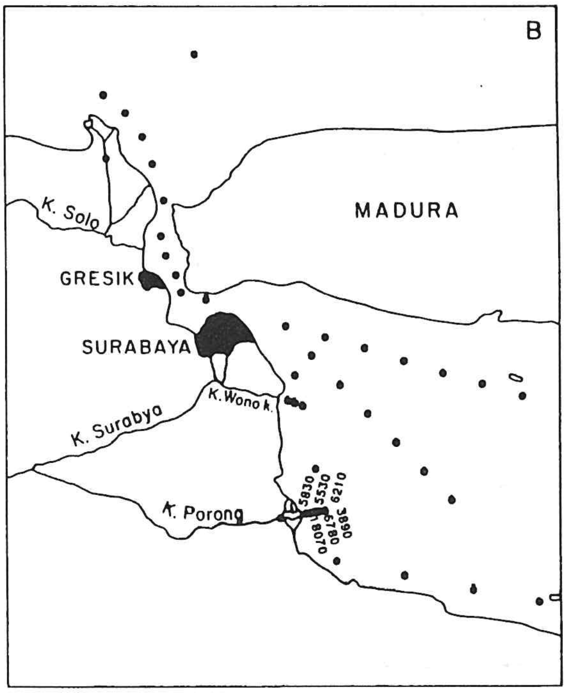
cu Madure - periode A



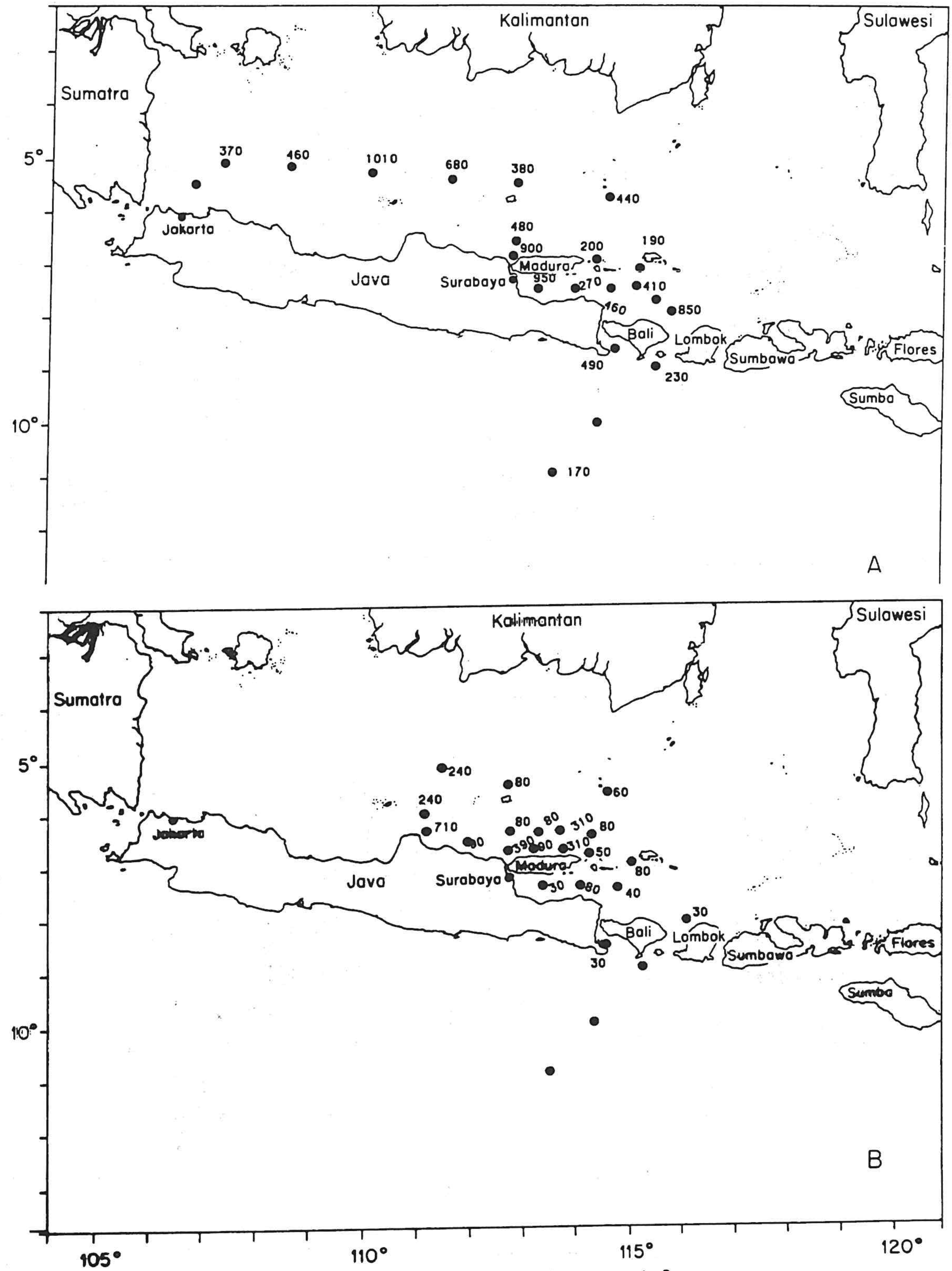
cu Madure - periode B



zn Madure - periode A



zn Madure - periode B



Java - periode B

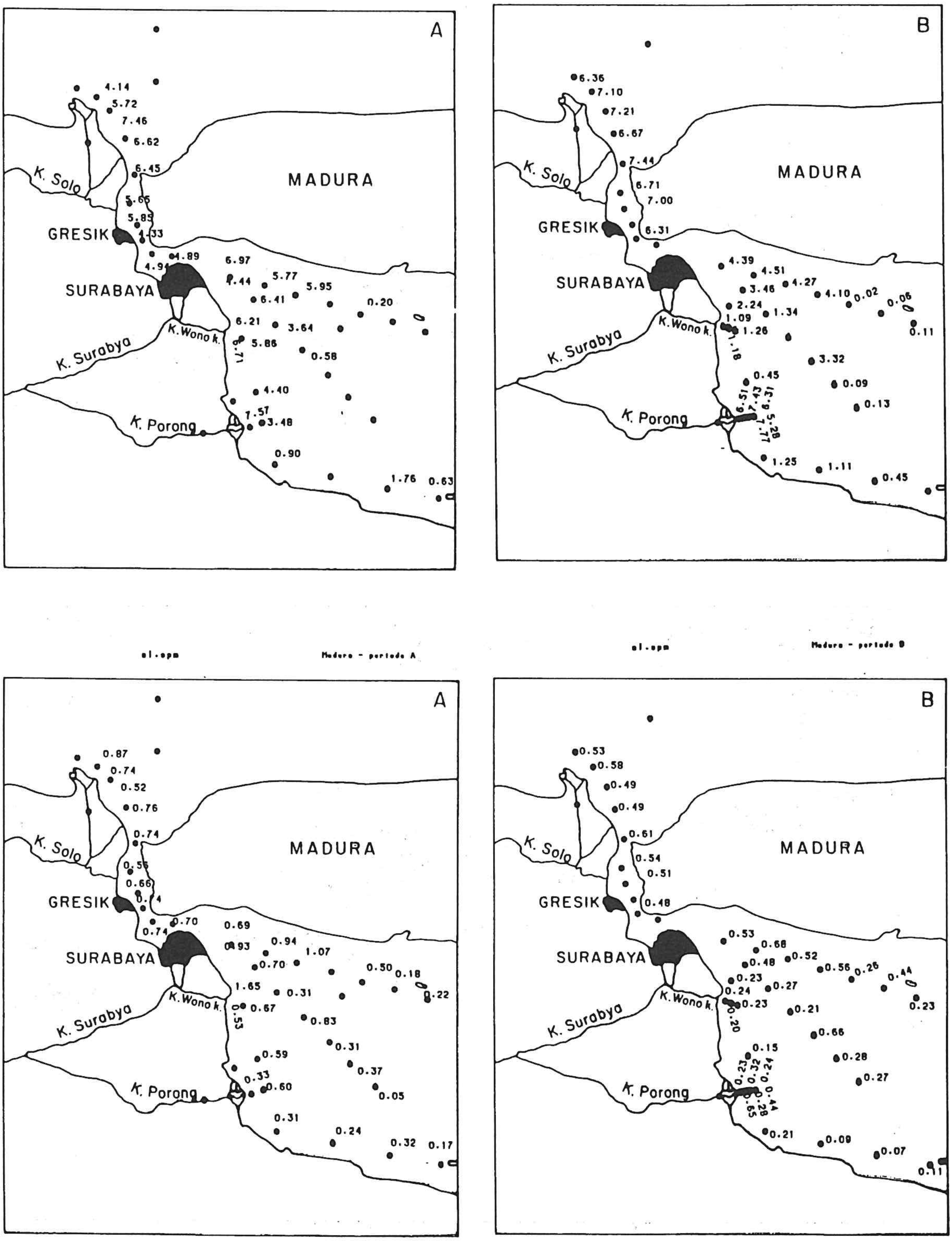
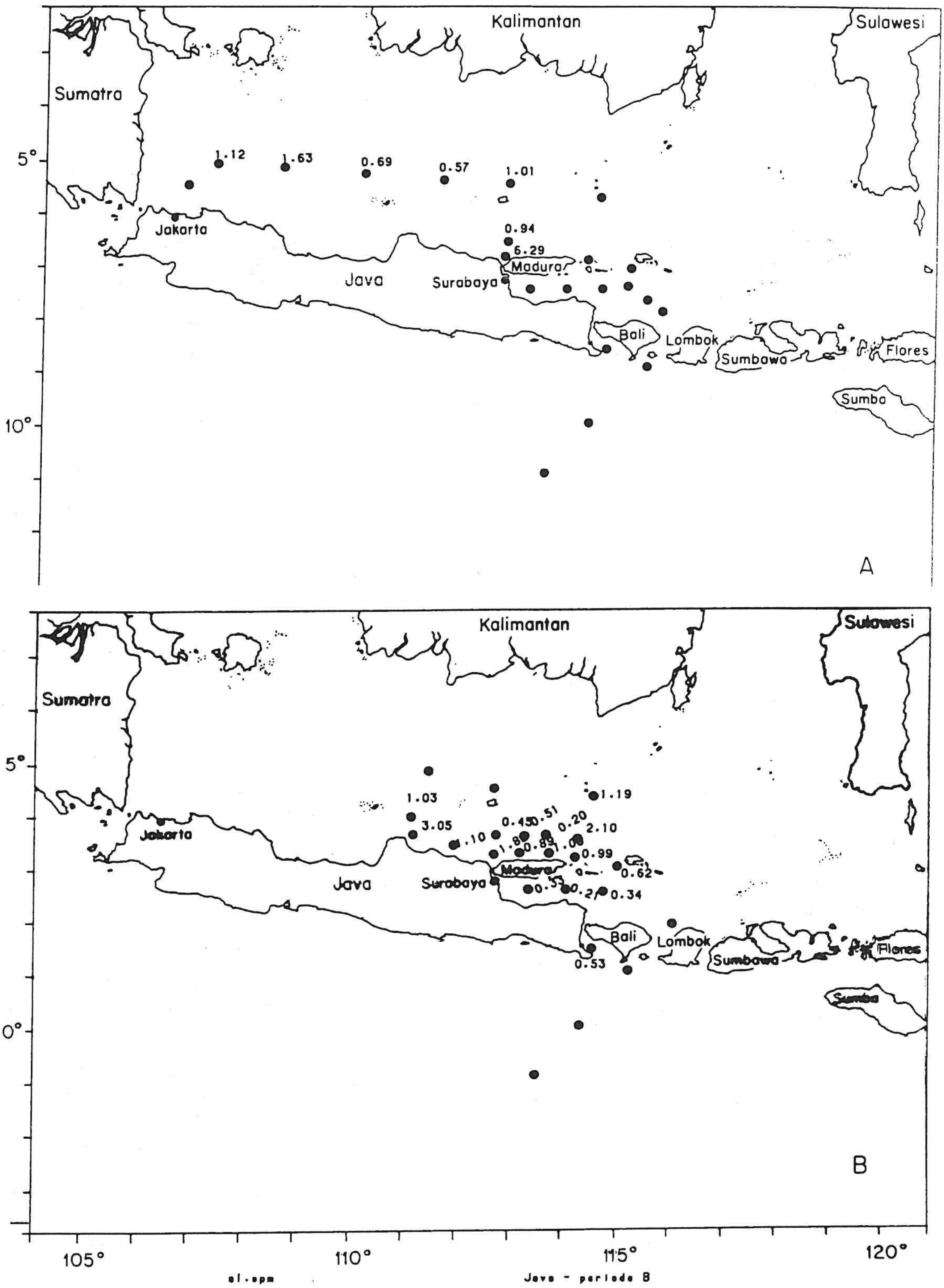
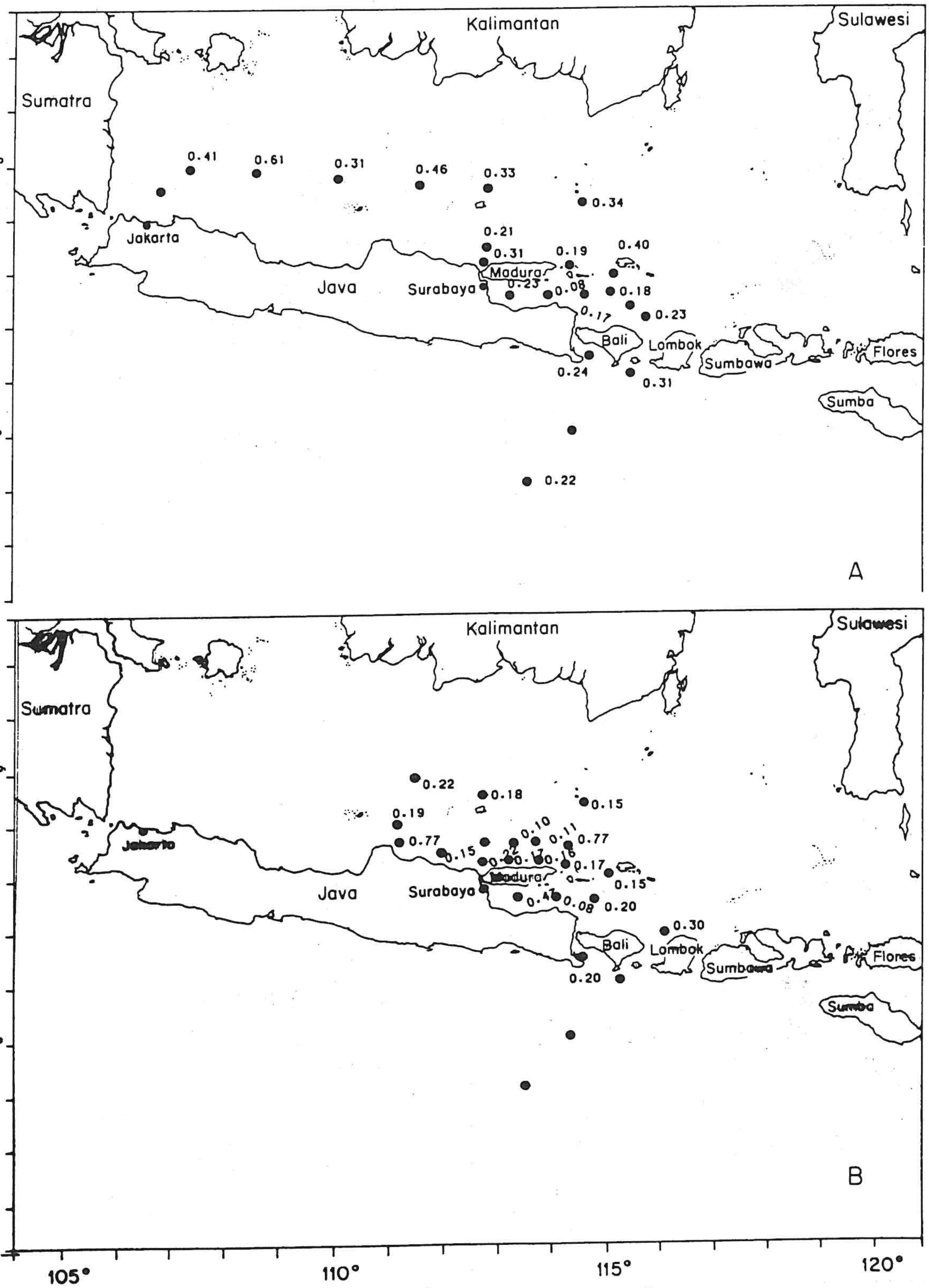


Fig 24

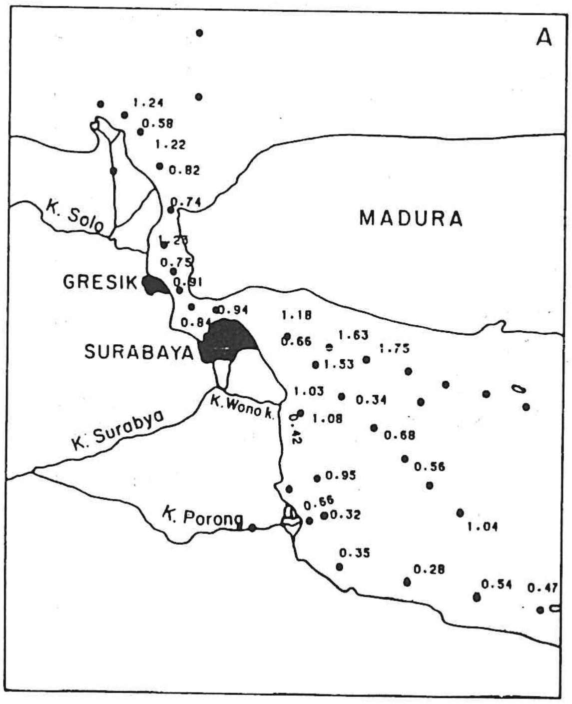
Concentrations of Al, K, Ca, Si, Fe and Mg in the suspended matter fraction (%). A. First period. B. Second period.

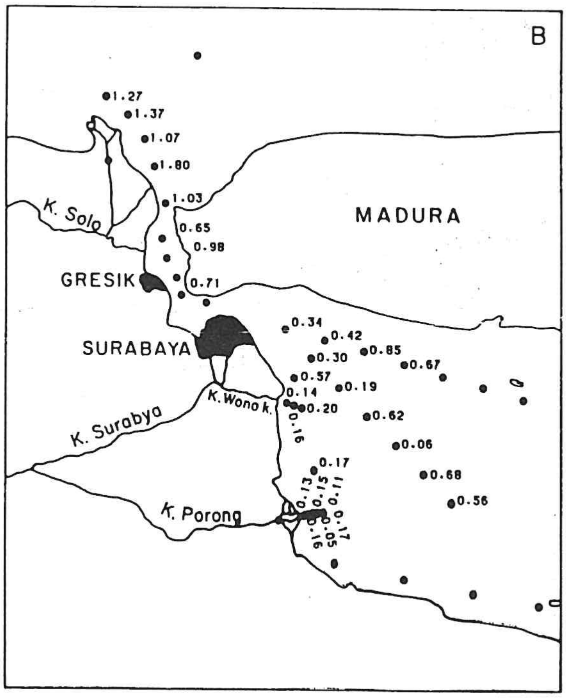

Kalimantan
Sulawesi
Sumatra
5°
1.12
1.63
0.69
0.57
1.01
Jakarta
0.94
6.29
Madura
Java
Surabaya
Bali
Lombok
Sumbawa
Flores
Sumba
10°
A
Kalimantan
Sulawesi
Sumatra
5°
1.03
1.19
3.05
Jakarta
2.10
0.99
0.62
Java
Surabaya
Madura
0.34
Bali
Lombok
Sumbawa
Flores
Sumba
0.53
10°
B
105°
110°
115°
120°
Java - periode B



k.apm

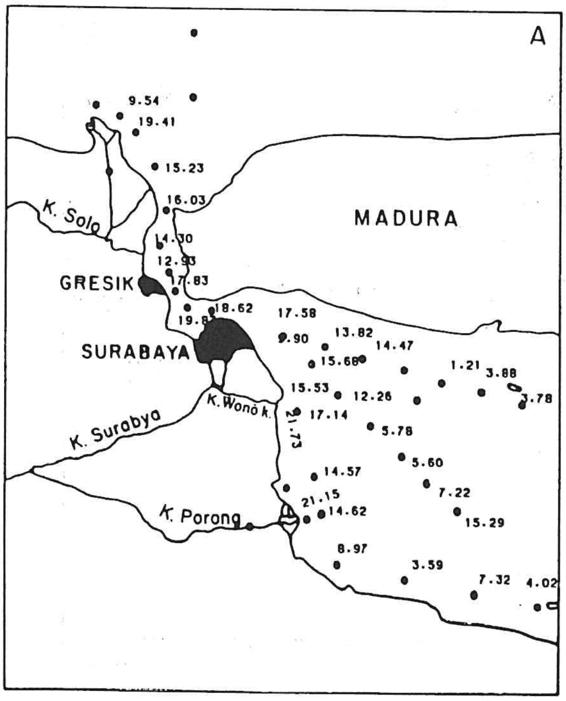
Java - periode B

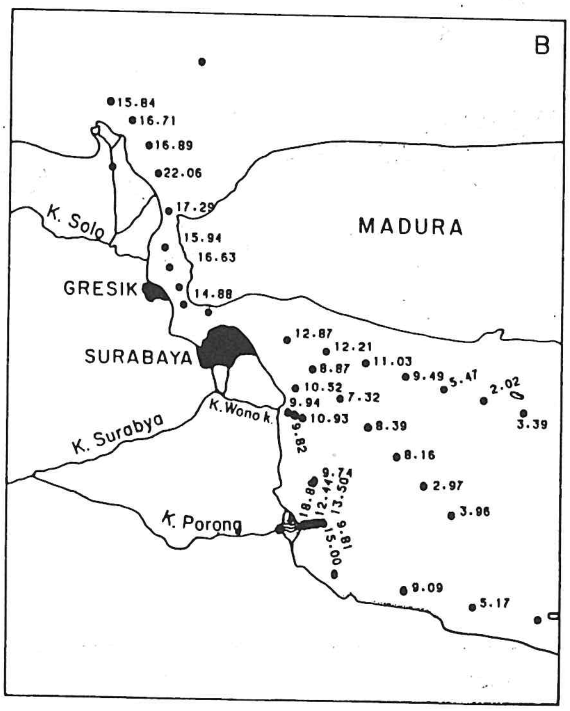




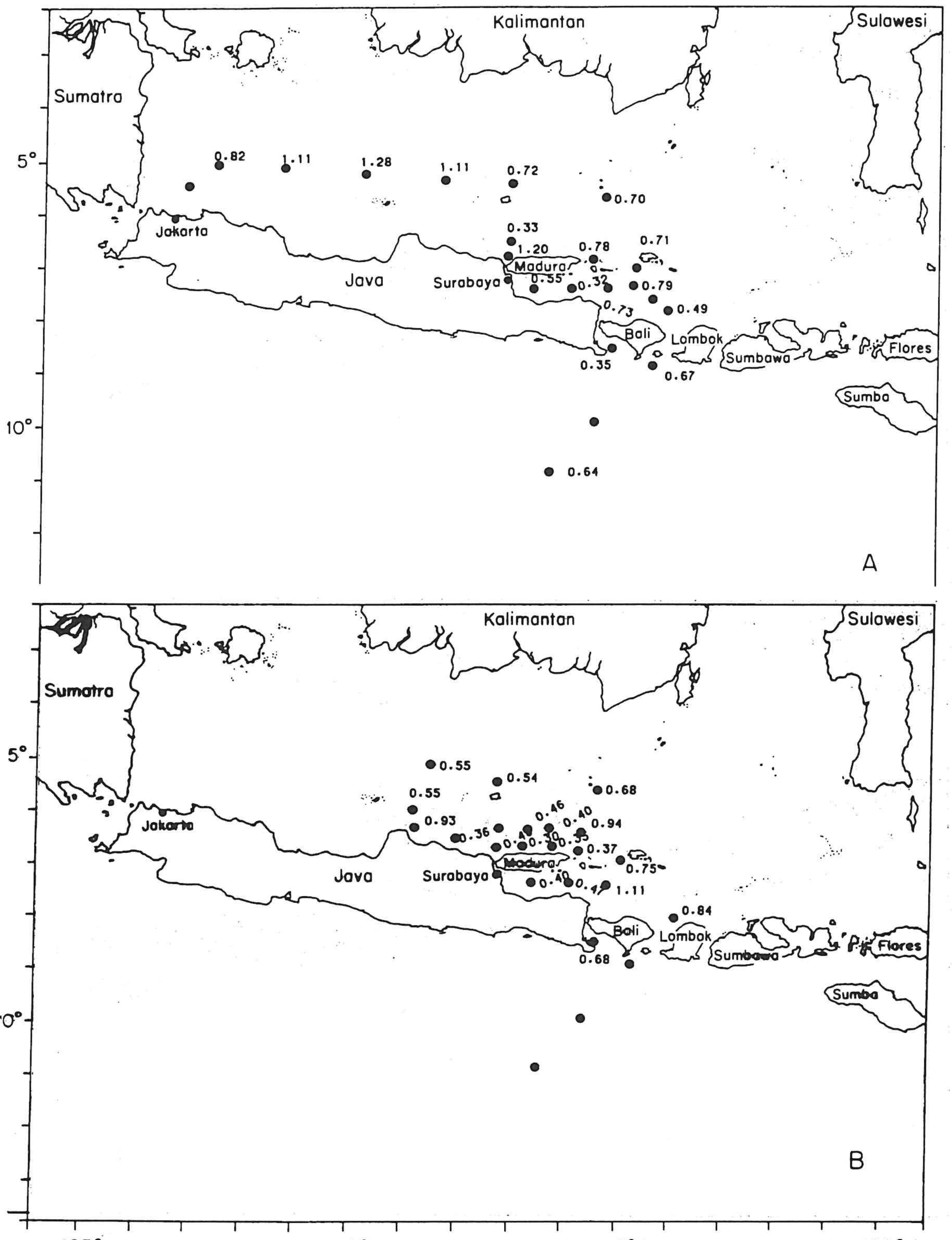
cu-ppm Madura - periode A

cu-ppm Madura - periode B



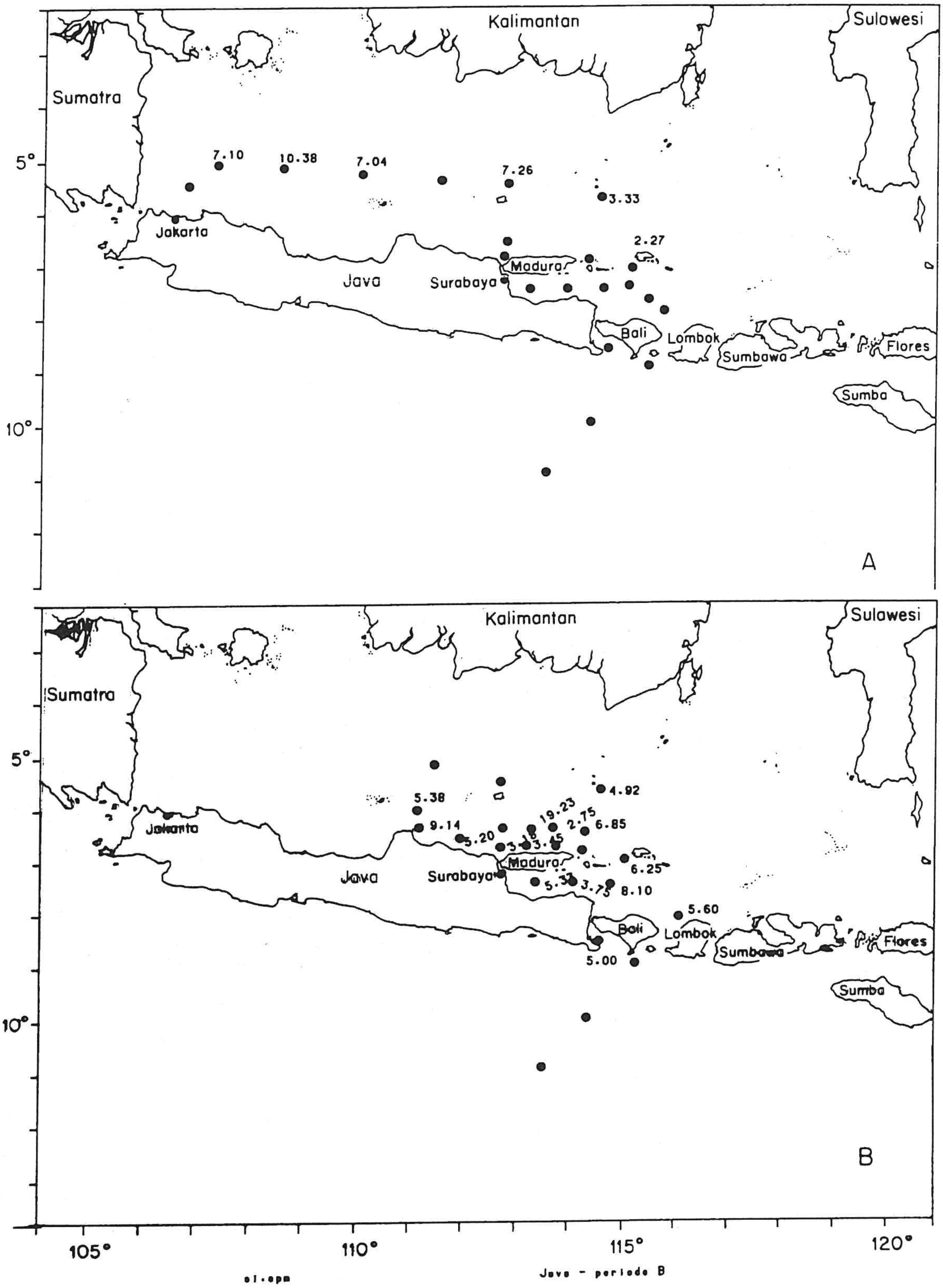


cl-ppm Madura - periode B



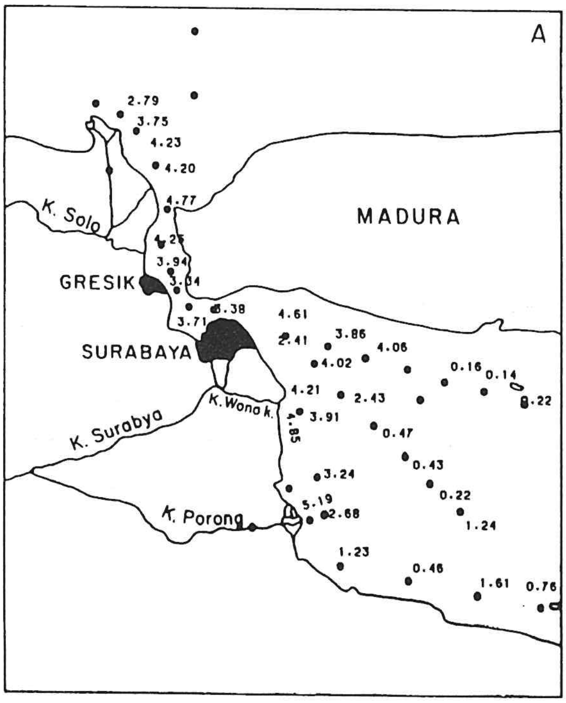
co-apm

Java - periode B

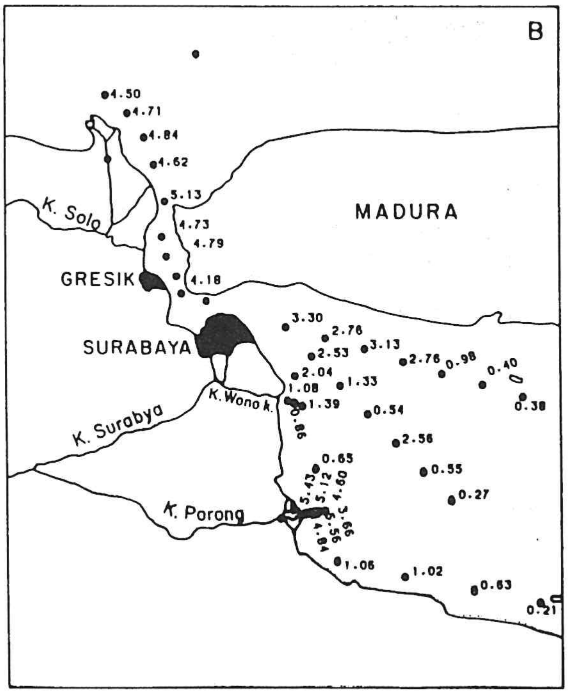


ol.apm

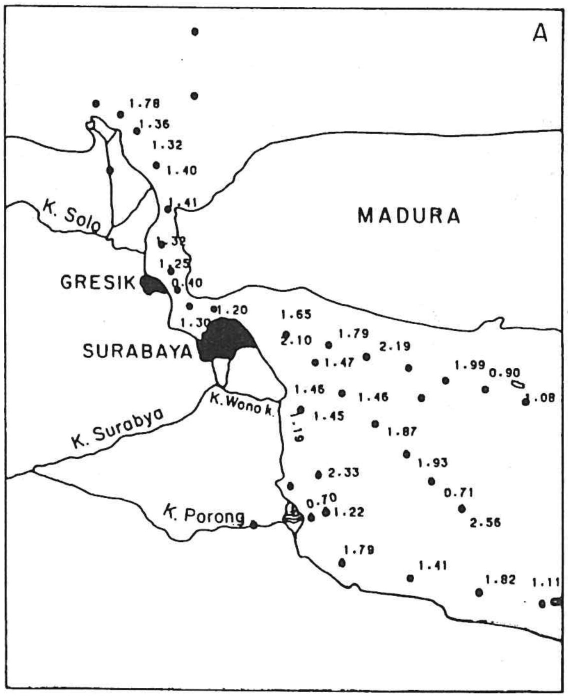
Java - periode B



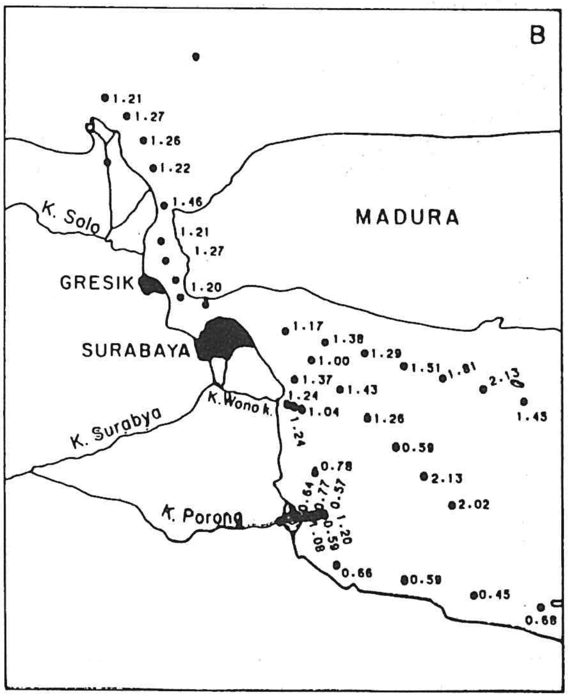
Fe.ppm Madura - periode A



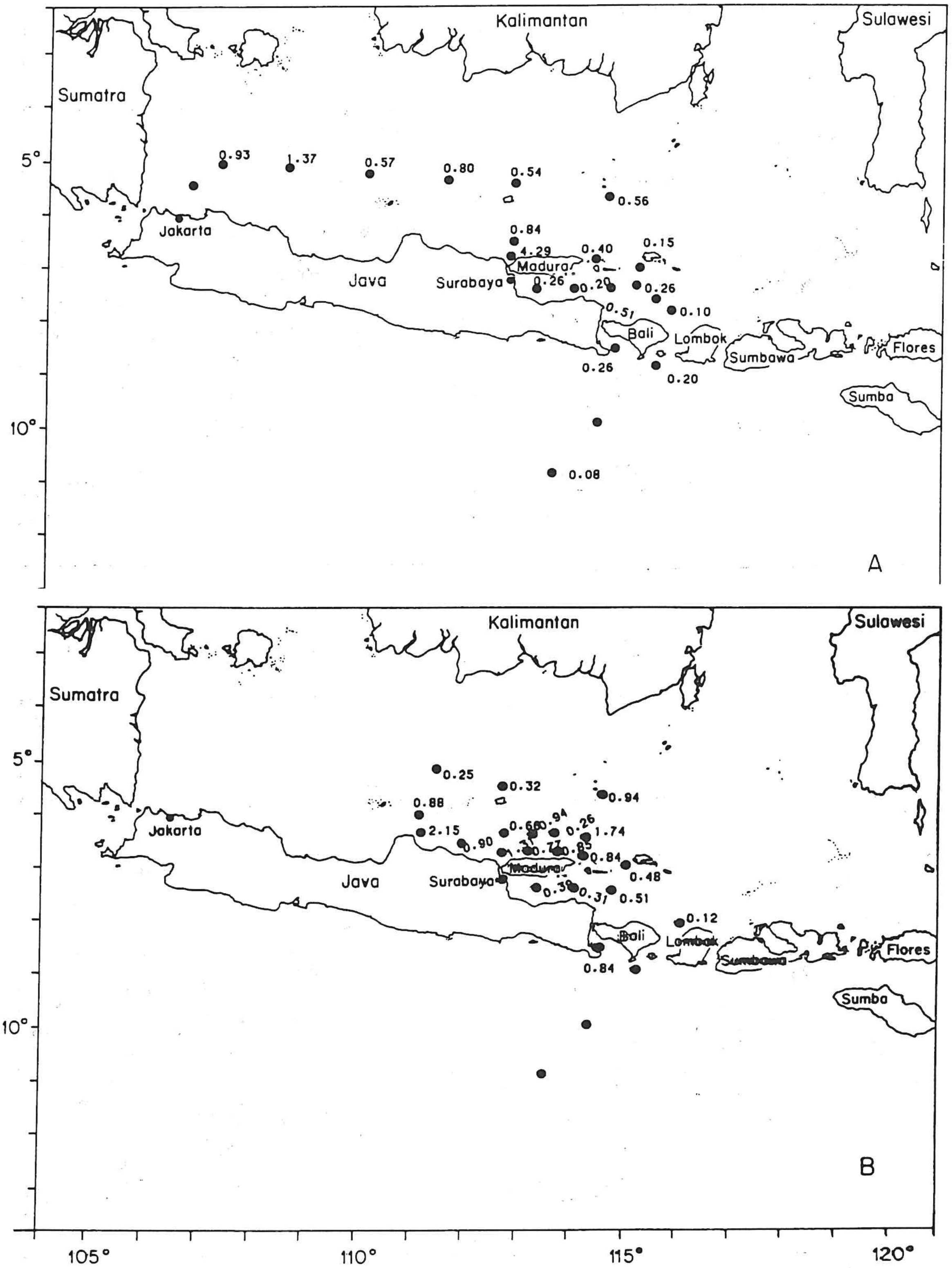
Fe.ppm Madura - periode B



Mg.ppm Madura - periode A

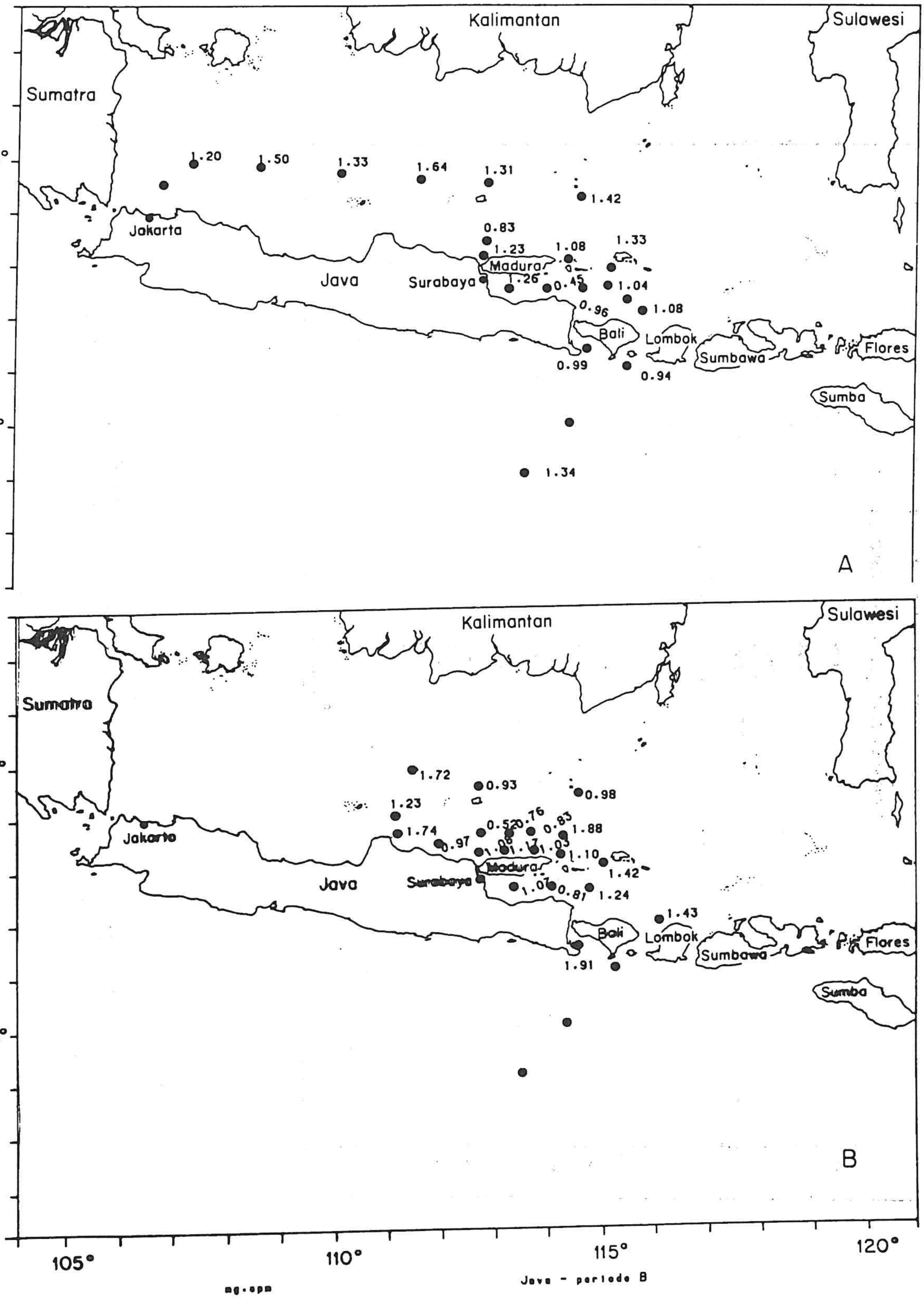


Mg.ppm Madura - periode B



fe.spm

Java - periode B


Kalimantan
Sulawesi
Sumatra
5°
10°
Jakarta
Java
Surabaya
Madura
Bali
Lombok
Sumbawa
Flores
Sumba
1.20
1.50
1.33
1.64
1.31
1.42
0.83
1.23
1.08
1.33
1.26
0.45
1.04
0.96
1.08
0.99
0.94
1.34
A
1.72
0.93
0.98
1.23
1.74
0.97
0.52
0.76
0.83
1.88
1.10
1.42
1.24
0.81
1.43
1.91
B
105°
110°
115°
120°
mg.apm
Java - periode B

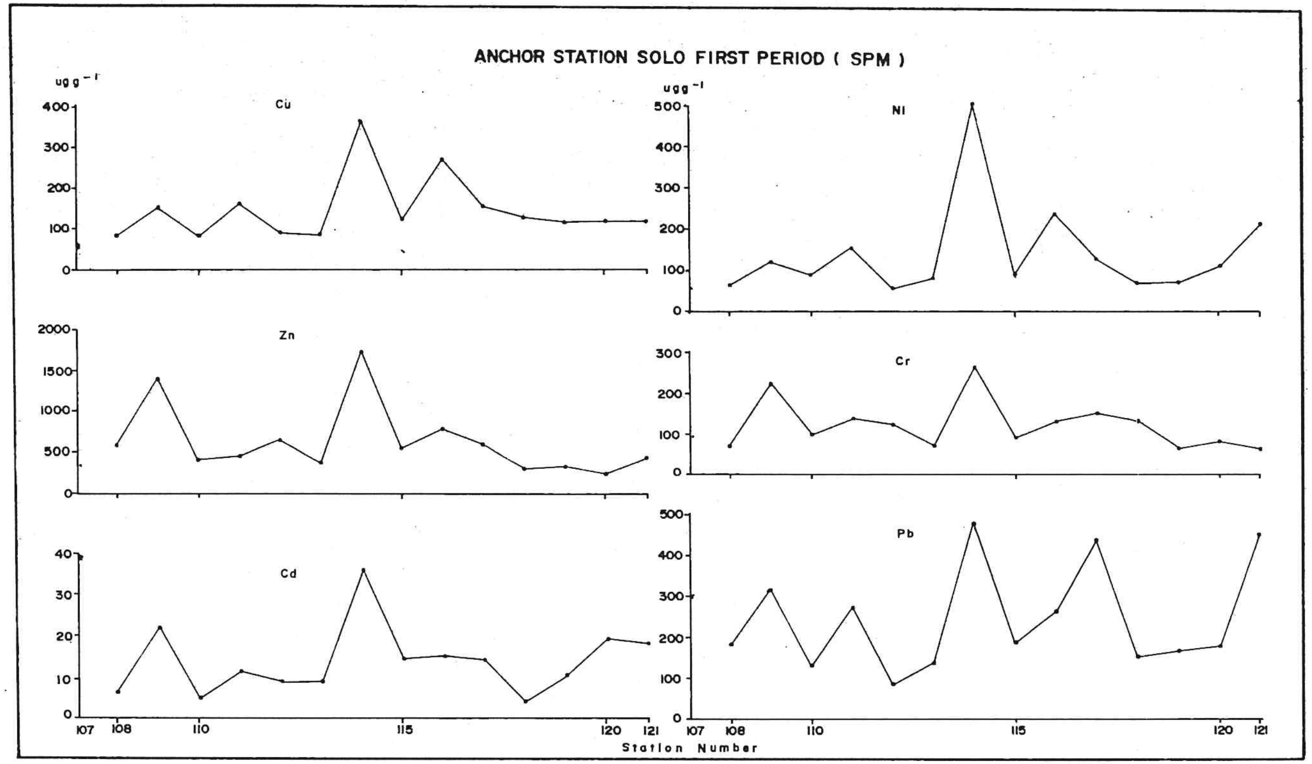
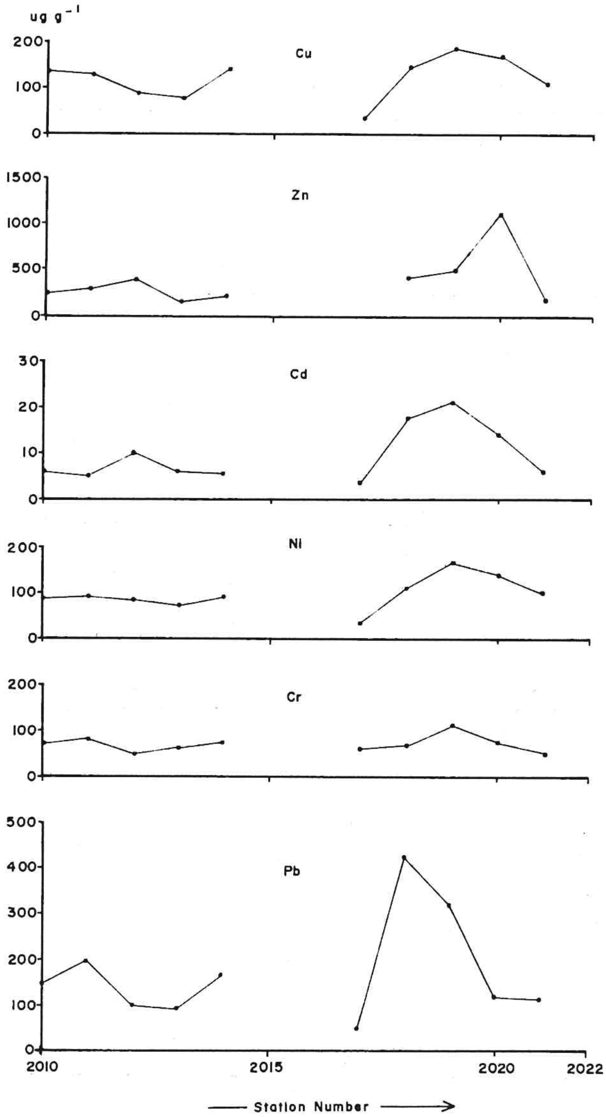


Fig 25

Concentration of Cu, Zn, Cd, Ni, Cr and Pb ($\mu g.g^{-1}$) in suspended matter in the river Solo. First and second period. Anchor Station.

ANCHOR STATION SOLO SECOND PERIOD
(SPM)



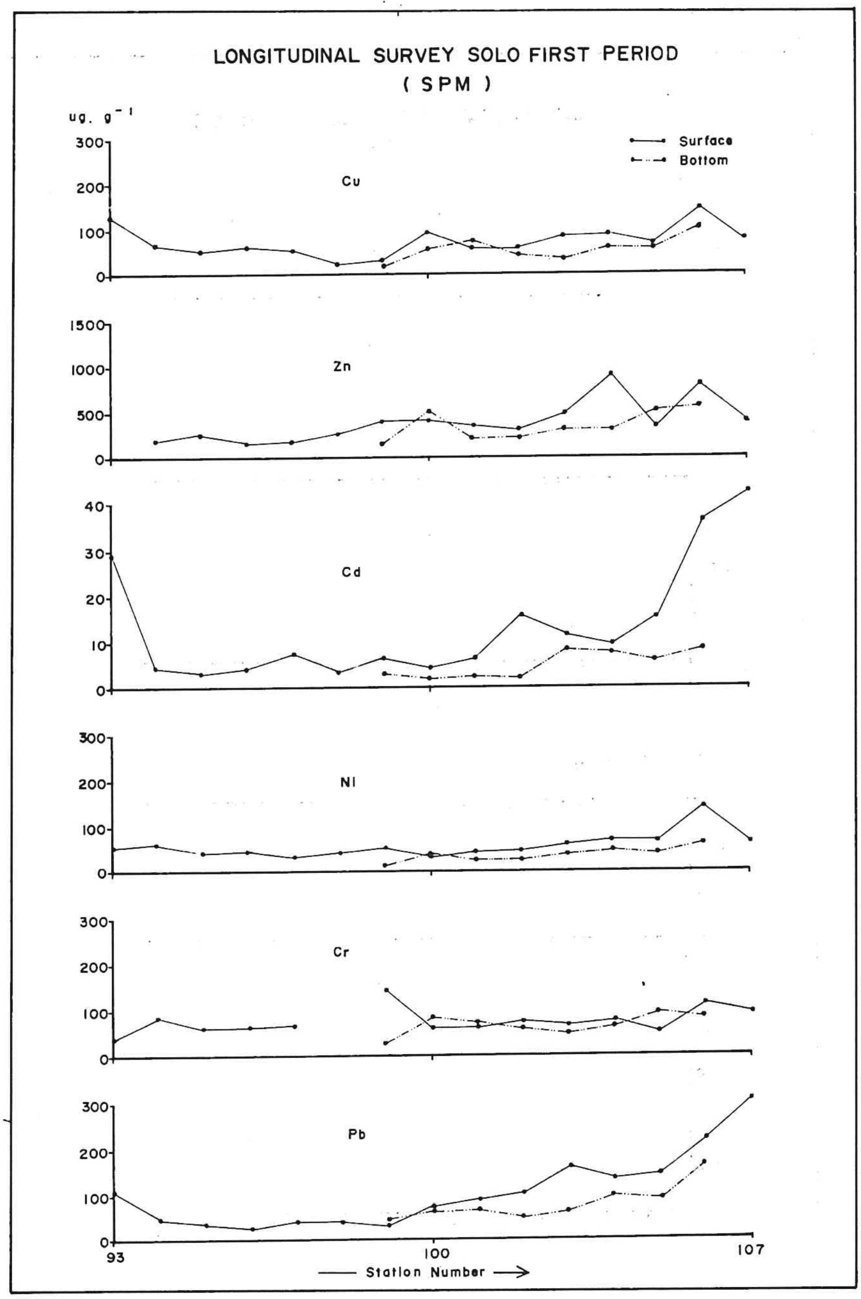
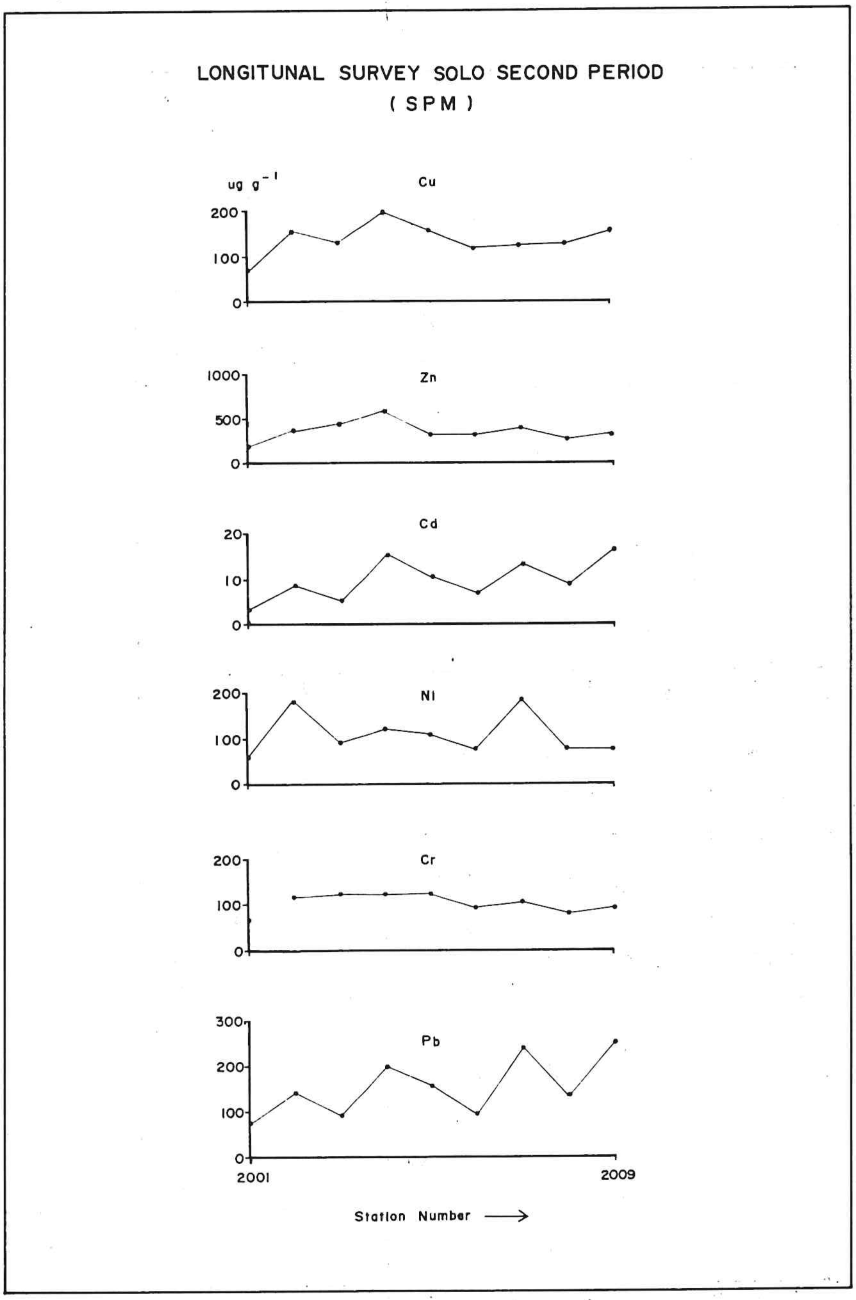


Fig 26

Concentrations of Cu, Zn, Cd, Ni, Cr and Pb ($\mu g.g^{-1}$) in suspended matter in the Solo. Longitudinal survey, first and second period .________. surface data ..... bottom data.


LONGITUNAL SURVEY SOLO SECOND PERIOD
(SPM)
ug g^{-1}
Cu
200
100
0
Zn
1000
500
0
Cd
20
10
0
Ni
200
100
0
Cr
200
100
0
Pb
300
200
100
0
2001
2009
Station Number

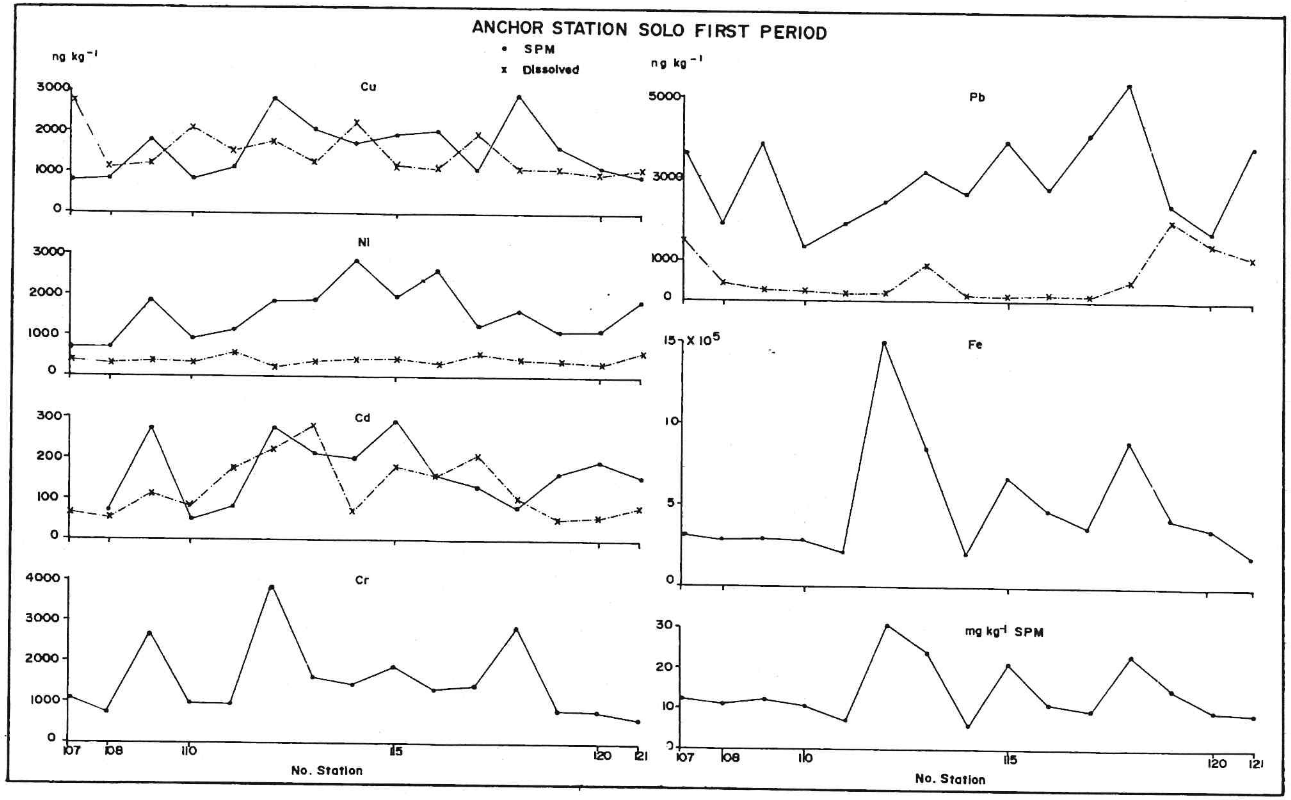


Fig 27

Concentrations of Cu, Ni, Cd, Cr, Fe and Pb (ng.kg^{-1}) in the dissolved (......) and particulate (.________.) phase in the Solo; anchor station first period. Suspended matter (mg.kg^{-1}).

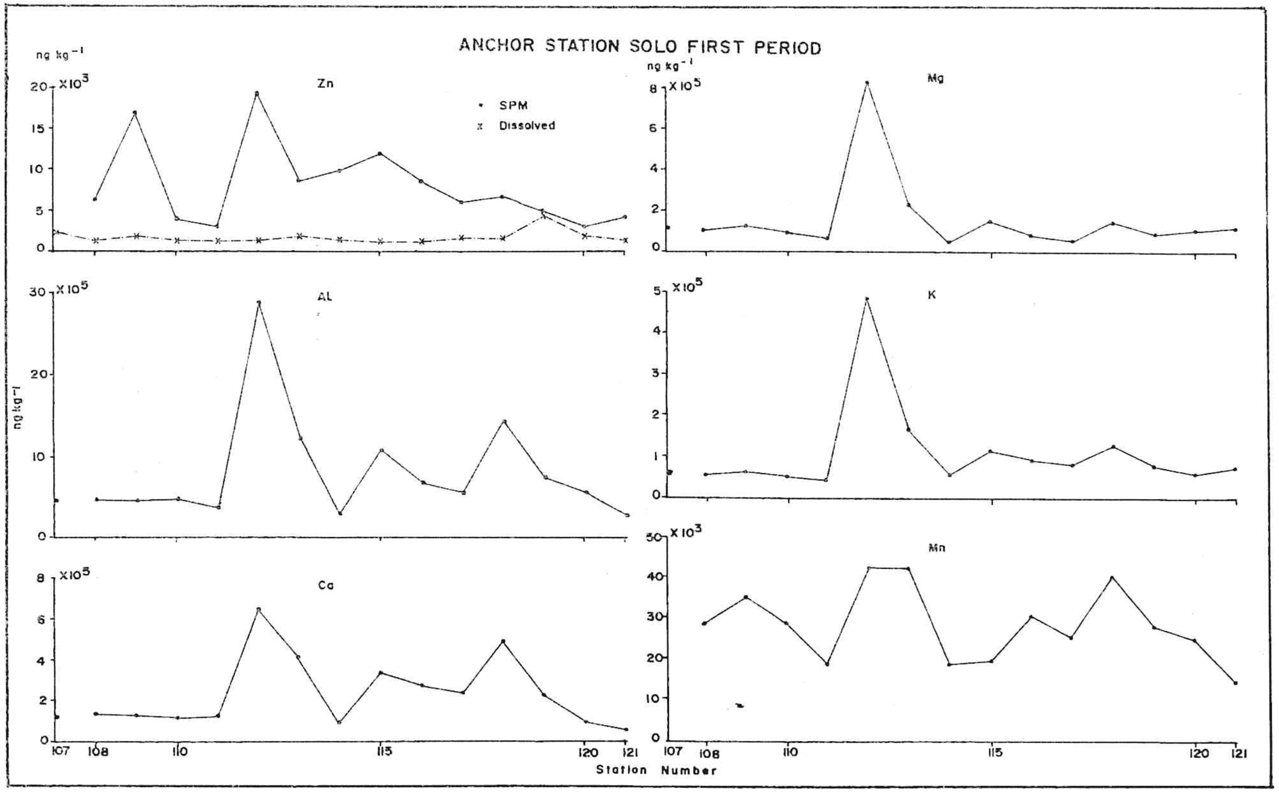


Fig 27A

Concentrations of Zn, Al, Ca, Mg, K and Mn ($ng.kg^{-1}$) in the particulate phase in the river Solo; anchor station first period. Zn (x....x) dissolved and (.-.) in particulate.

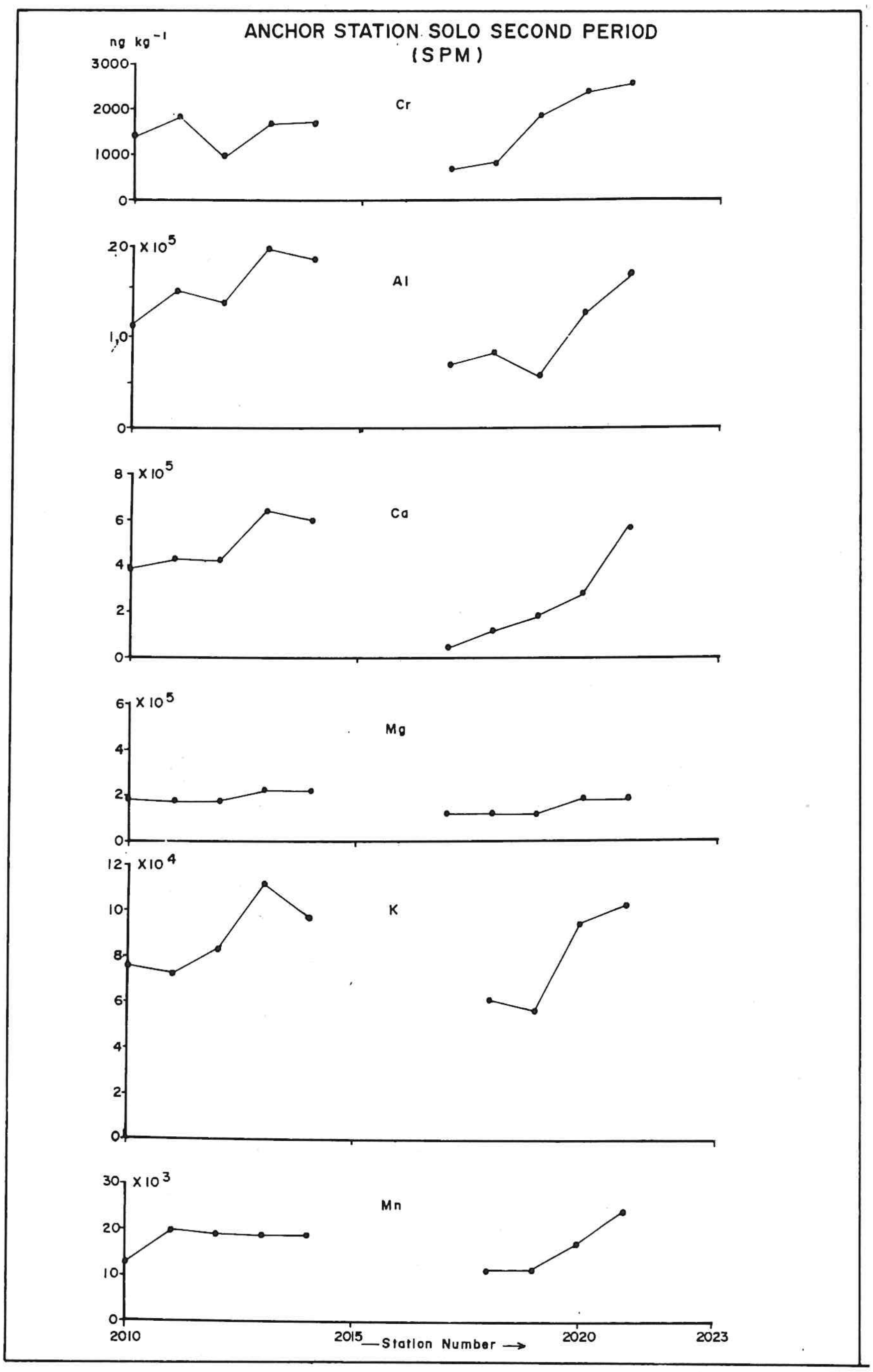


Fig 27A

Concentrations of Cr, Al, Ca, Mg, K and Mn ($ng.kg^{-1}$) in the particulate phase in the Solo anchor station second period.

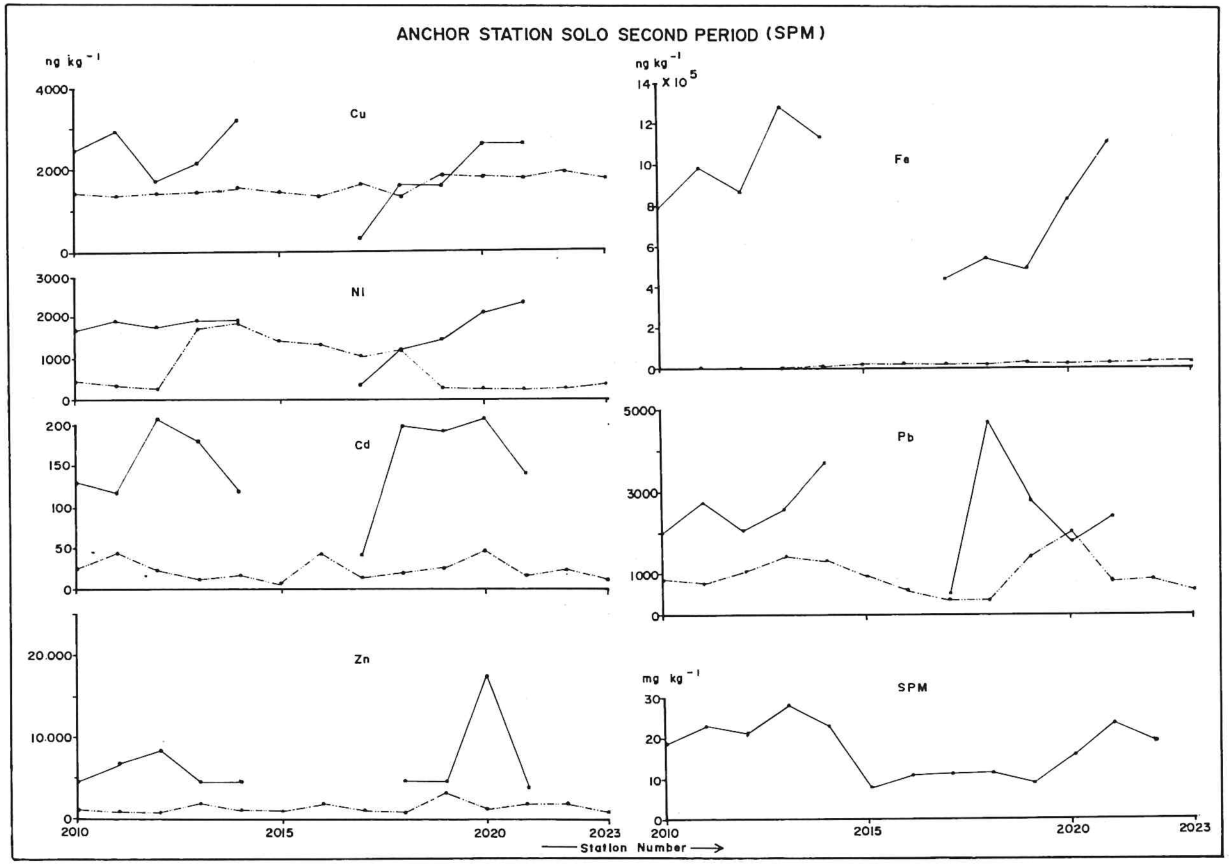


Fig 27B

Concentrations of Cu, Ni, Cd, Zn, Fe and Pb ($ng.kg^{-1}$)in the dissolved (.....) and particulate (._____.) phase and the suspended matter concentration ($mg\ kg^{-1}$) in the river Solo; anchor station, second period.

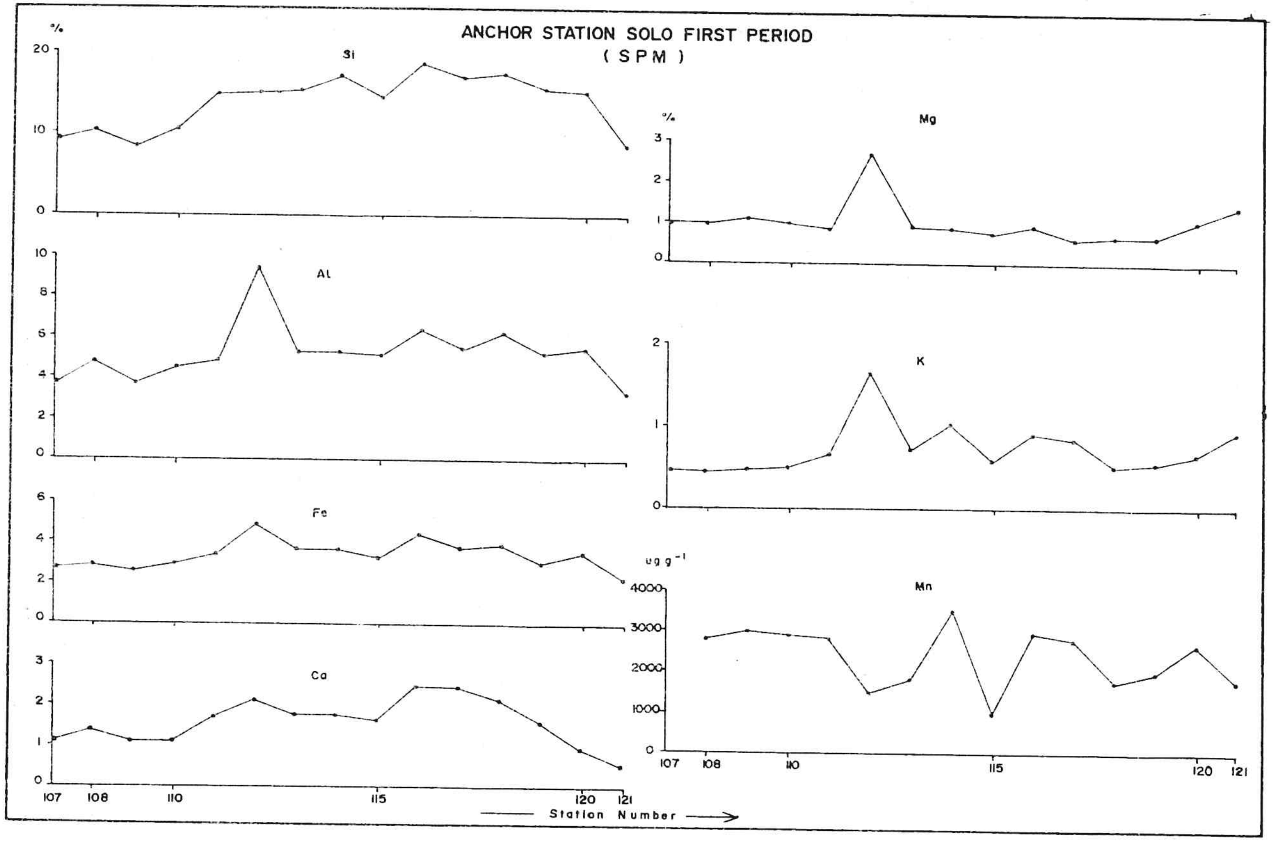
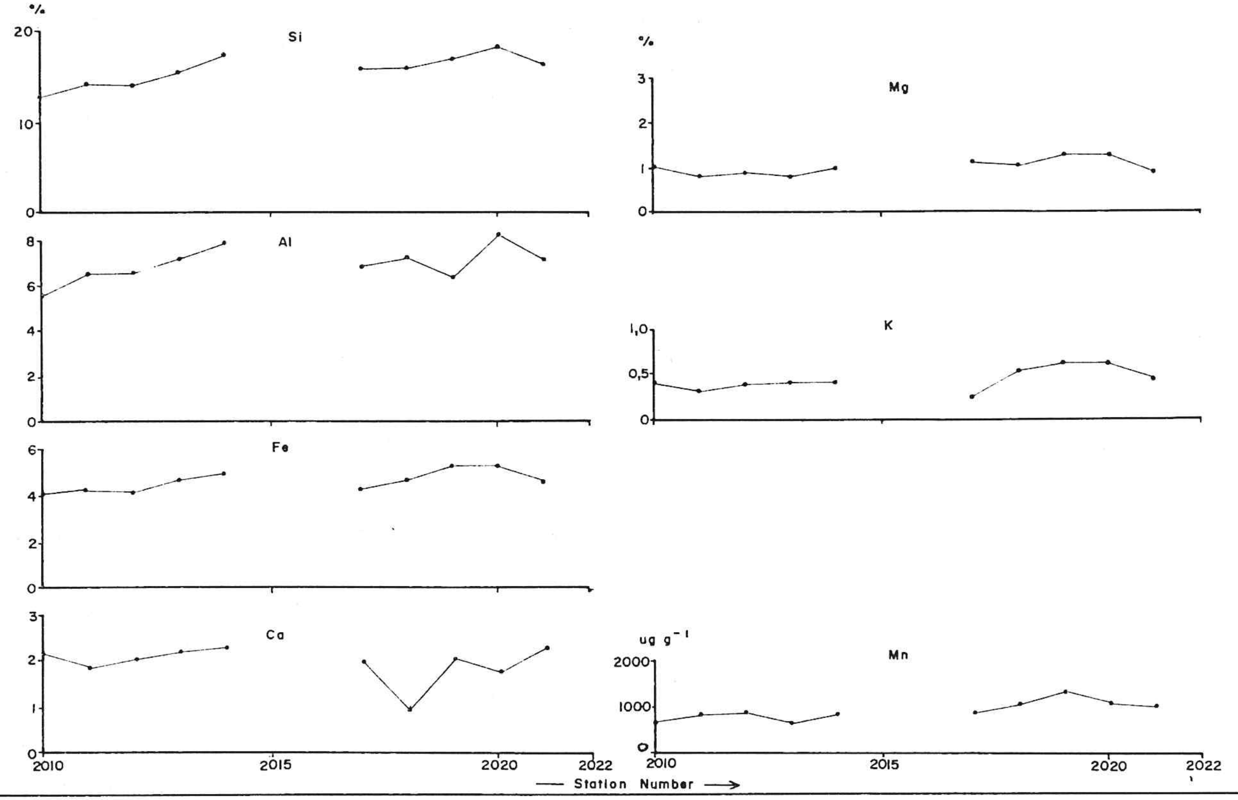


Fig 28

Concentrations of Si, Al, Fe, Ca, Mg and K (%) and Mn ($\mu g.g^{-1}$) in suspended matter in the Solo. First and second period. Anchor Station.

ANCHOR STATION SOLO SECOND PERIOD (SPM)



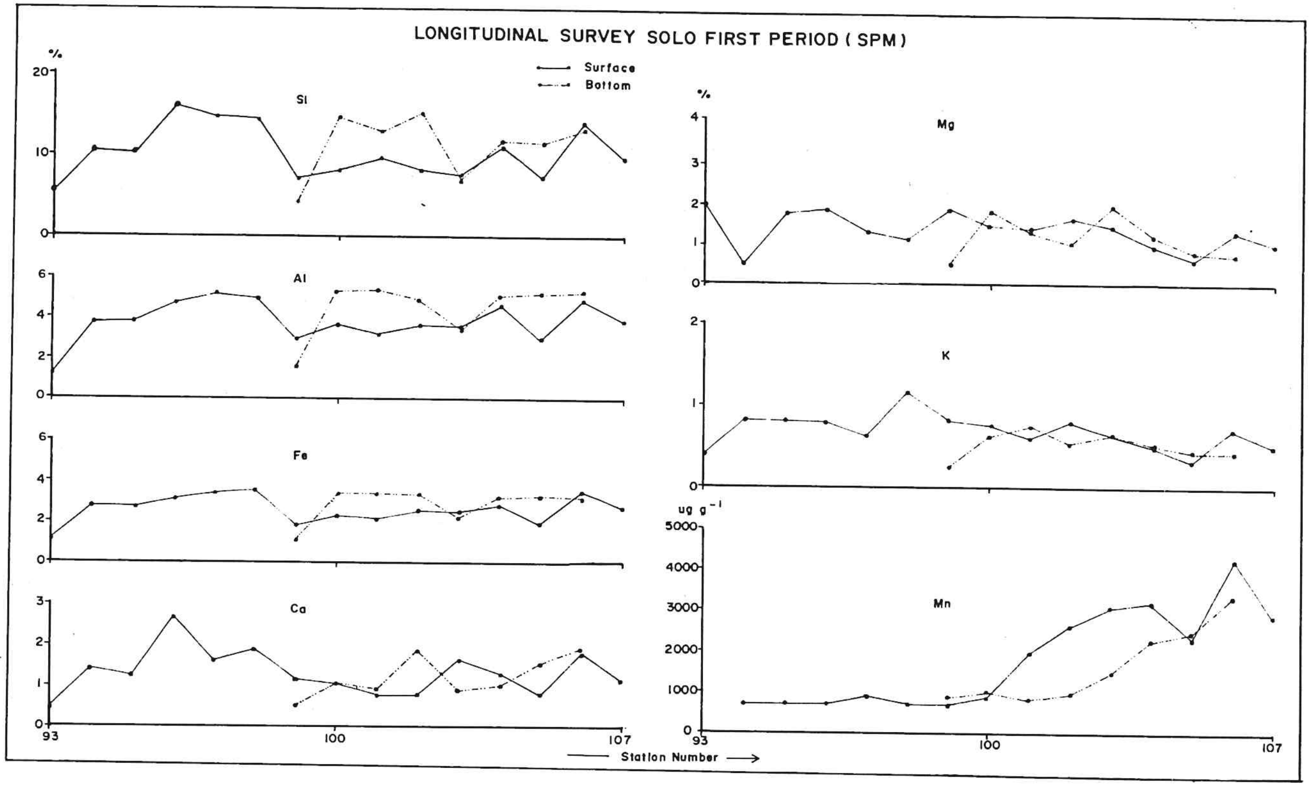
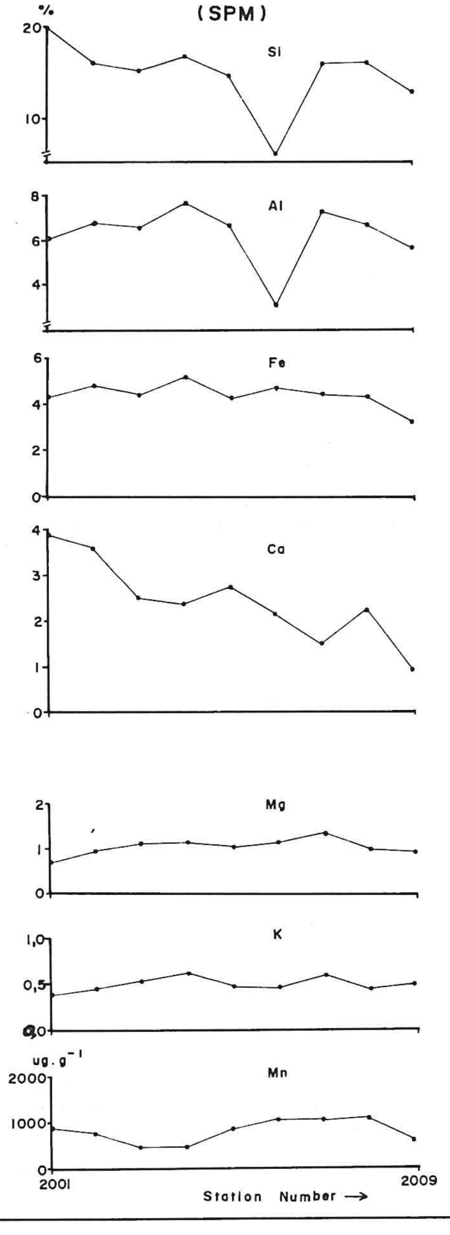


Fig 29

Concentrations of Si, Al, Fe, Ca, Mg and K (%) and Mn ($\mu g.g^{-1}$) in suspended matter in the Solo. Longitudinal survey, first and second period. .______. surface data ... bottom data.

LONGITUDINAL SURVEY SOLO SECOND PERIOD
(SPM)



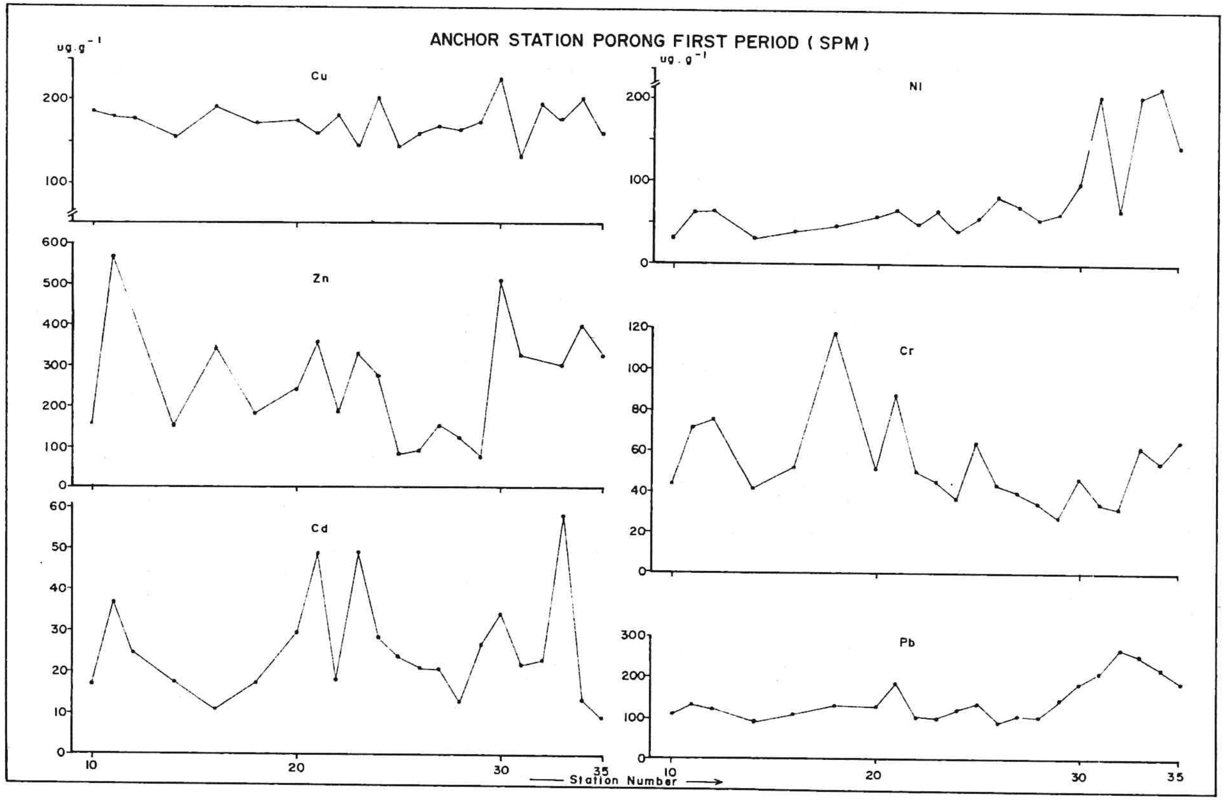
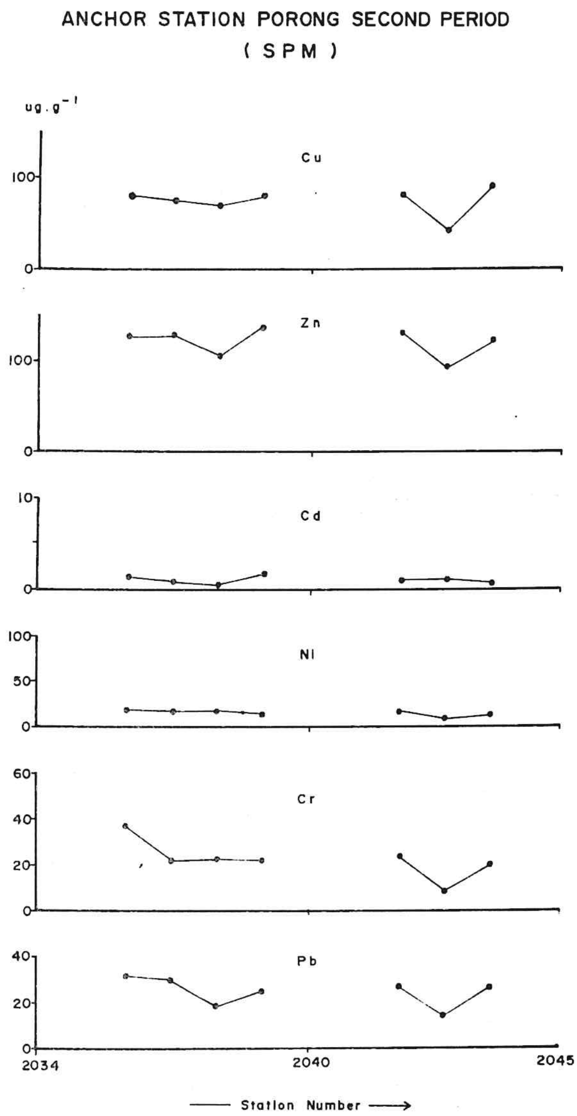


Fig 30

Concentration of Cu, Zn, Cd, Ni, Cr and Pb in suspended matter ($\mu g.g^{-1}$) in the Porong. First and second period anchor station.


ANCHOR STATION PORONG SECOND PERIOD
(SPM)
ug.g⁻¹
Cu
Zn
Cd
Ni
Cr
Pb
100
0
10
50
60
40
20
2034
2040
2045
Station Number

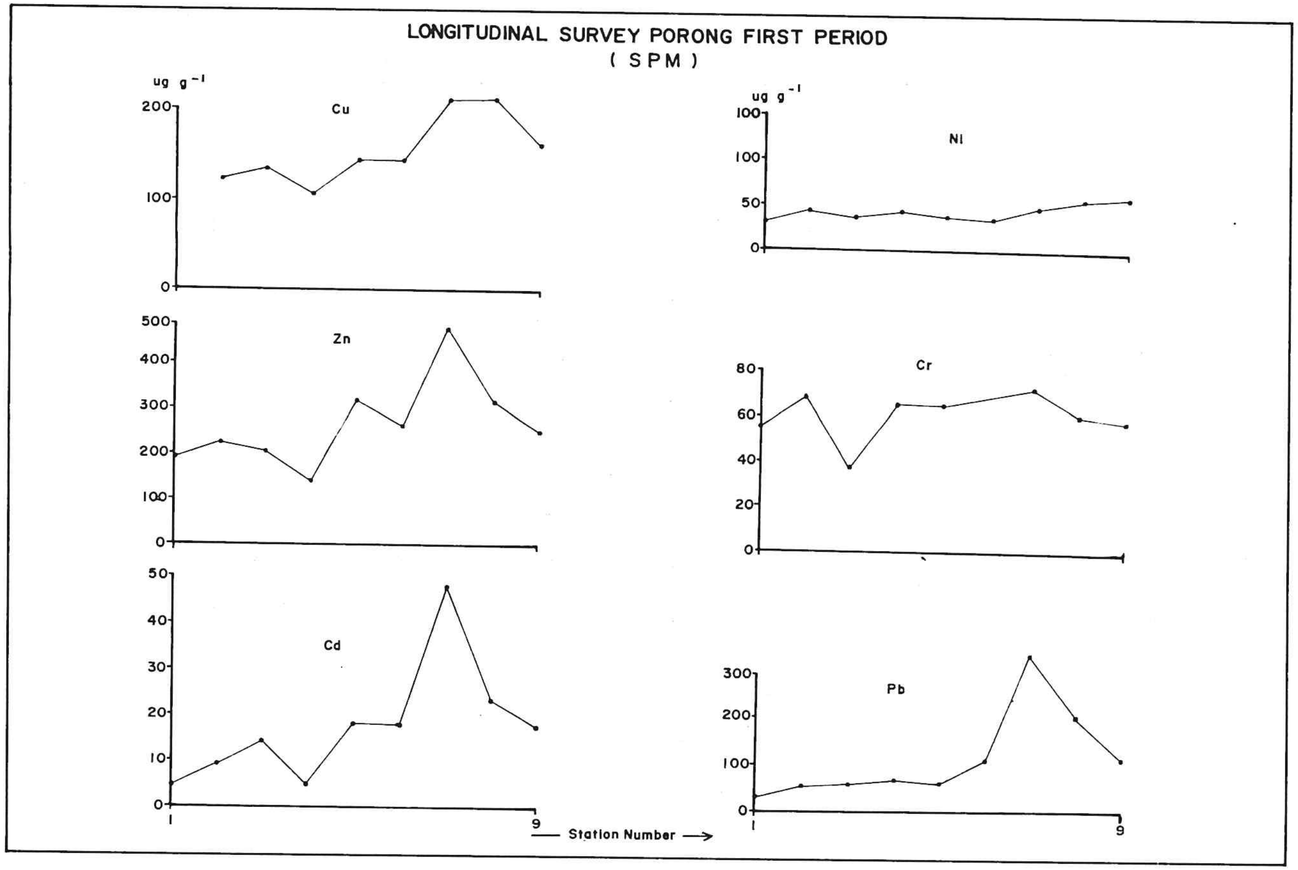


Fig 31

Concentrations of Cu, Zn, Cd, Ni, Cr and Pb ($\mu g.g^{-1}$) in suspended matter in the Porong. Longitudinal survey, first period.

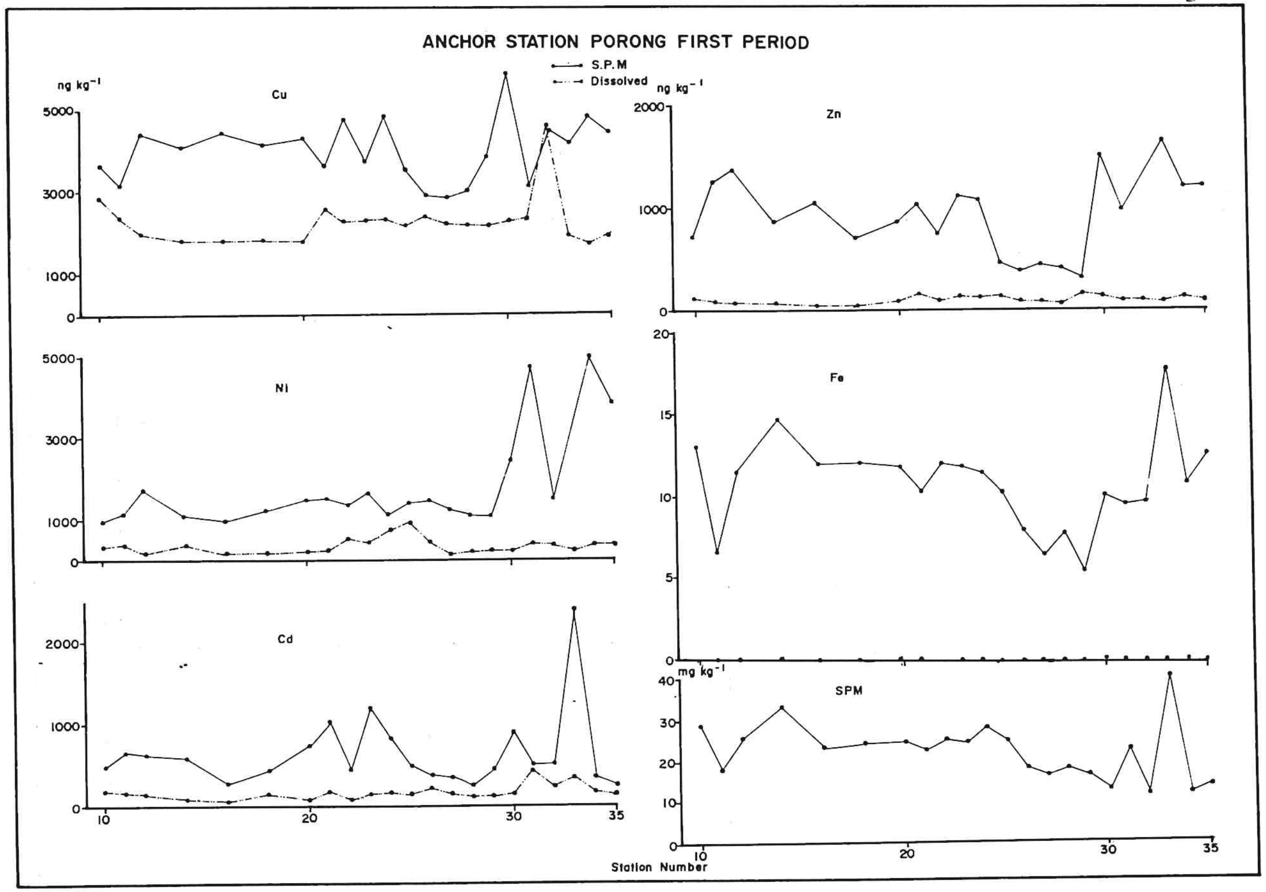
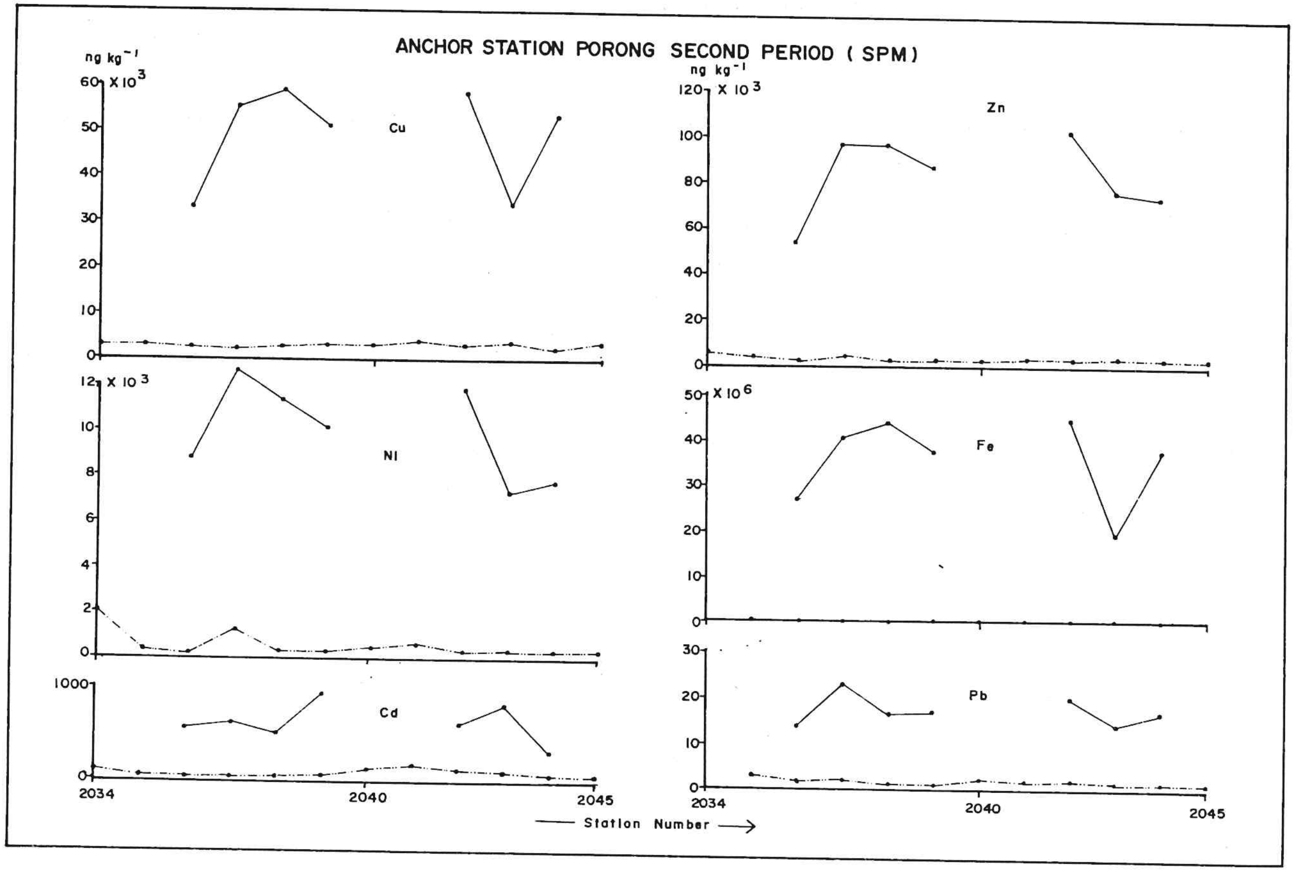


Fig 32

Concentrations of Cu, Ni, Cd, Zn, Fe and Pb $ng.kg^{-1}$ in the dissolved (...) and particulate (...) phase , in the river Porong. Anchor station first and second period. Suspended matter concentration in $mg.kg^{-1}$.


ANCHOR STATION PORONG SECOND PERIOD (SPM)
ng kg⁻¹
60 X 10³
50
40
30
20
10
0
Cu
12 X 10³
10
8
6
4
2
0
Ni
1000
0
Cd
2034
2040
2045
ng kg⁻¹
120 X 10³
100
80
60
40
20
0
Zn
50 X 10⁶
40
30
20
10
0
Fe
30
20
10
0
Pb
2034
2040
2045
Station Number →

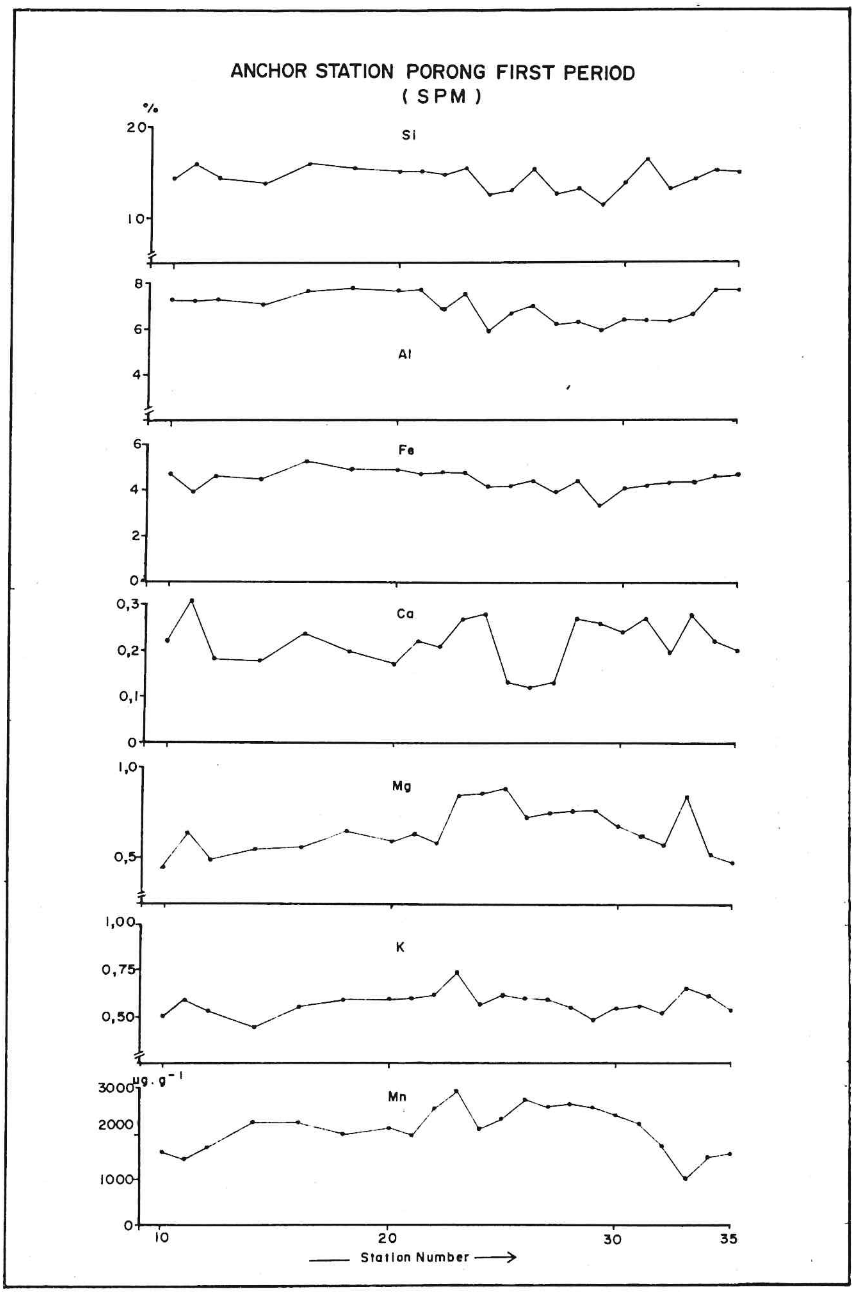
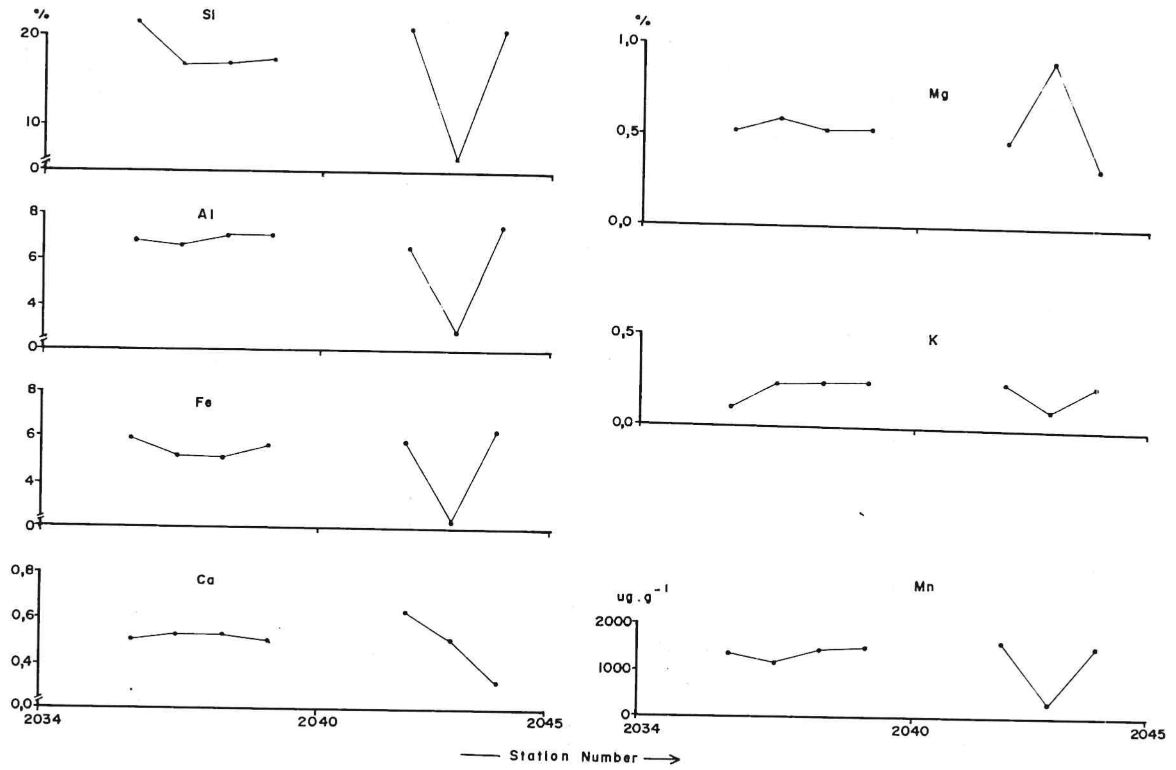


Fig 33

Concentration of Si, Al, Fe, Ca, Mg and K (%) and Mn ($\mu g.g^{-1}$) in suspended matter in the Porong. First and second period. Anchor Station.

ANCHOR STATION PORONG SECOND PERIOD (SPM)



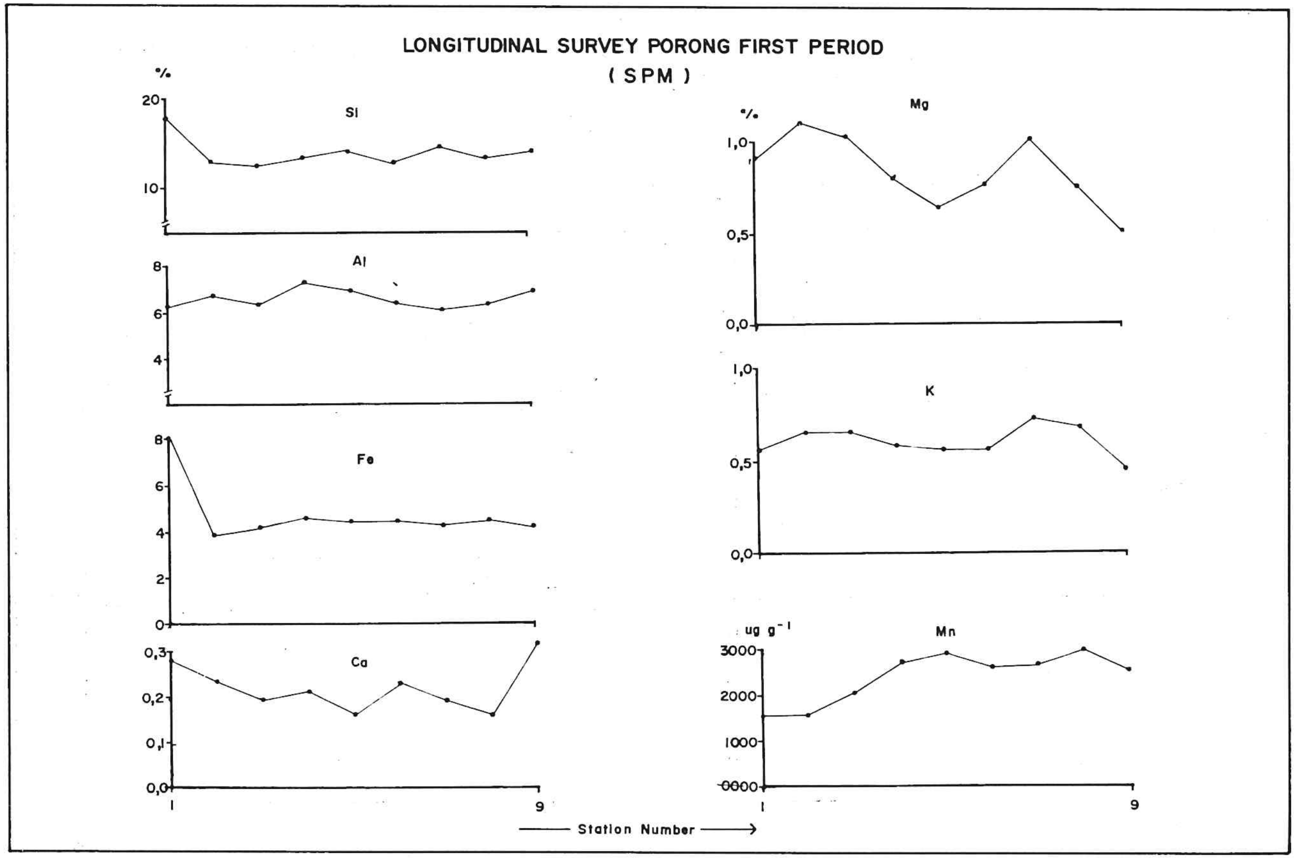


Fig 34

Concentrations of Si, Al, Fe, Ca, Mg and K (%) and Mn ($\mu g.g^{-1}$) in suspended matter in the Porong. Longitudinal survey, first period.

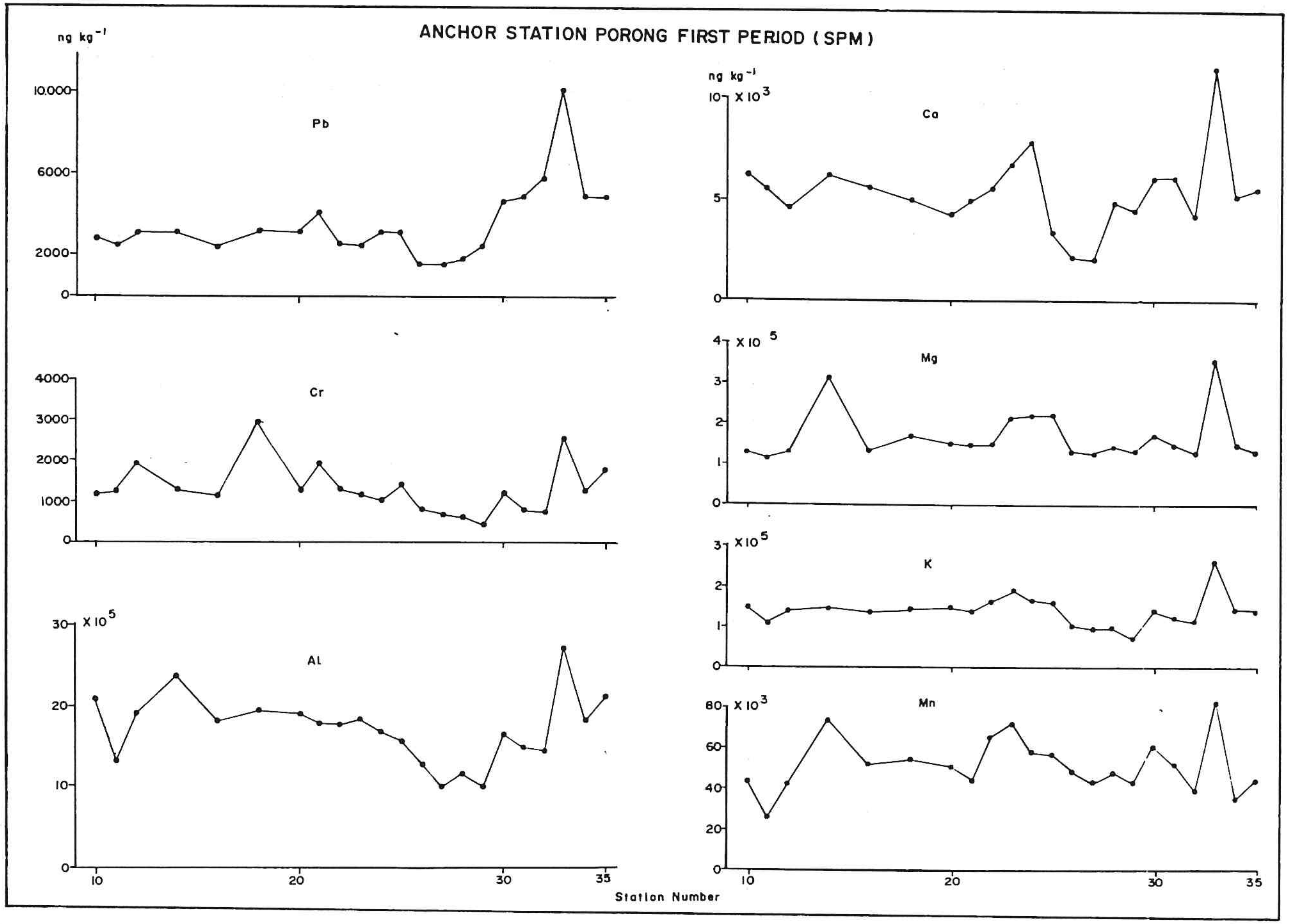
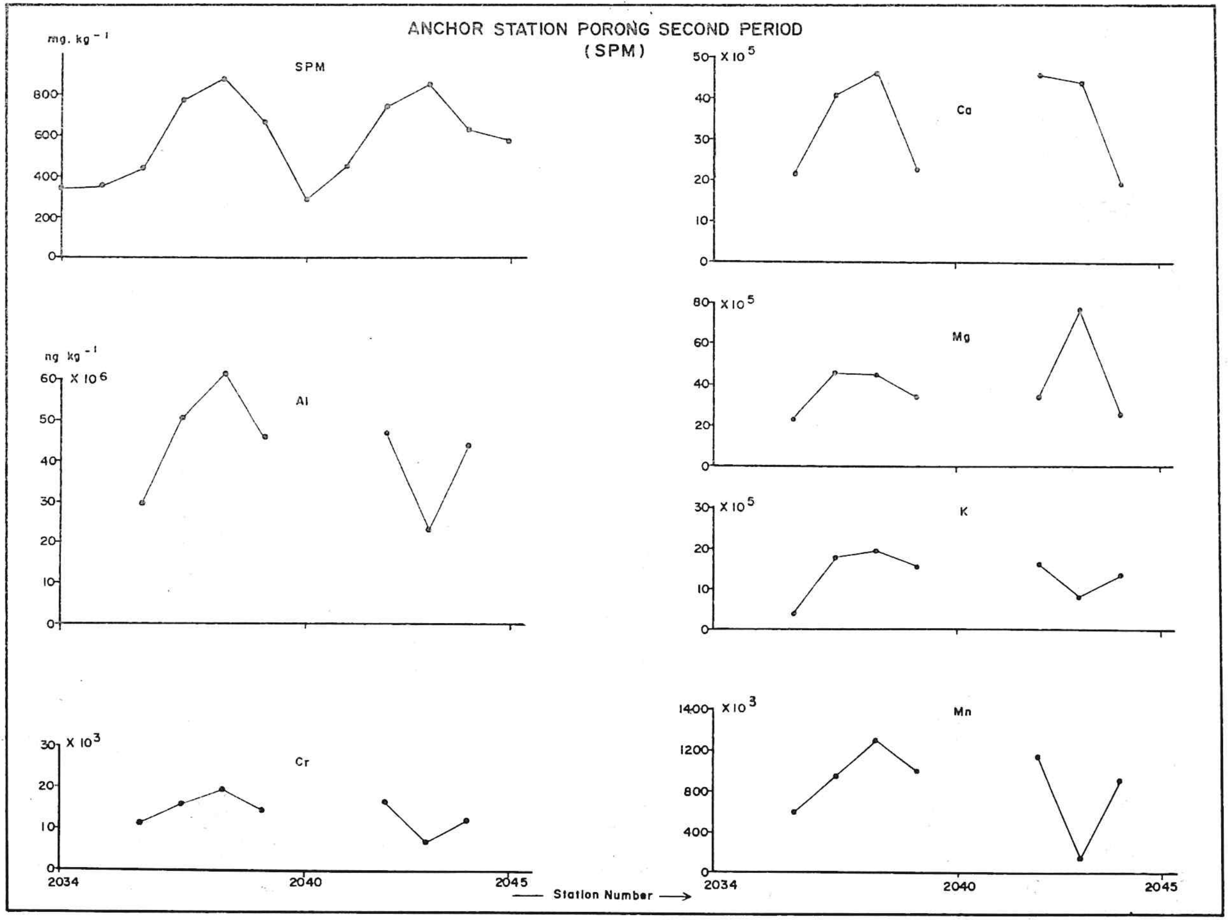
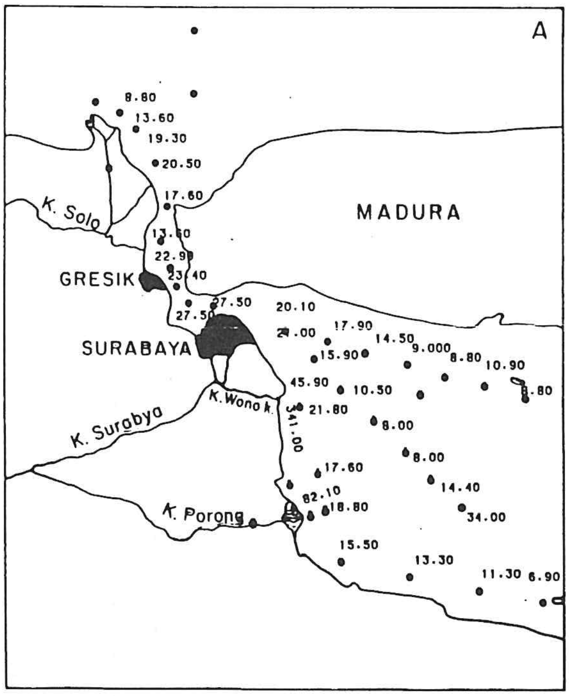


Fig 35

Concentrations of Pb, Cr, Al, Ca, Mg, K and Mn ($ng.kg^{-1}$) in the particulate phase in the Porong. Anchor station, first and second period. Suspended matter concentration in $mg.kg^{-1}$.


ANCHOR STATION PORONG SECOND PERIOD
(SPM)
mg. kg⁻¹
SPM
800
600
400
200
0
ng kg⁻¹
60 X 10⁶
50
40
30
20
10
0
Al
30 X 10³
20
10
0
Cr
2034
2040
2045
50 X 10⁵
40
30
20
10
0
Ca
80 X 10⁵
60
40
20
0
Mg
30 X 10⁵
20
10
0
K
1400 X 10³
1200
800
400
0
Mn
2034
2040
2045
Station Number



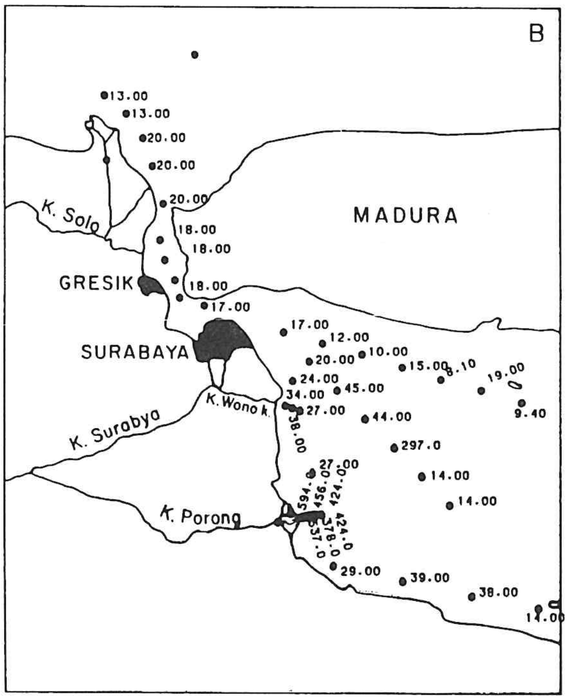


Fig 36

Concentrations of dissolved silicate, μmol.kg^{-1}.
A. First period. B. Second period.

Madura - periode B

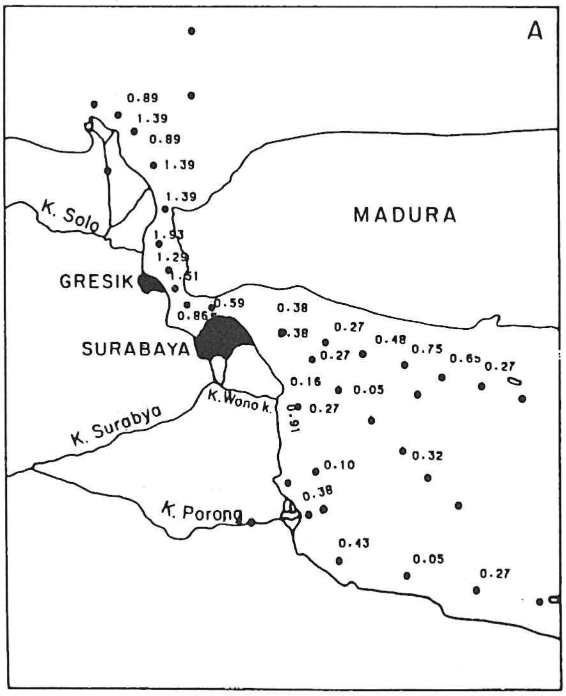
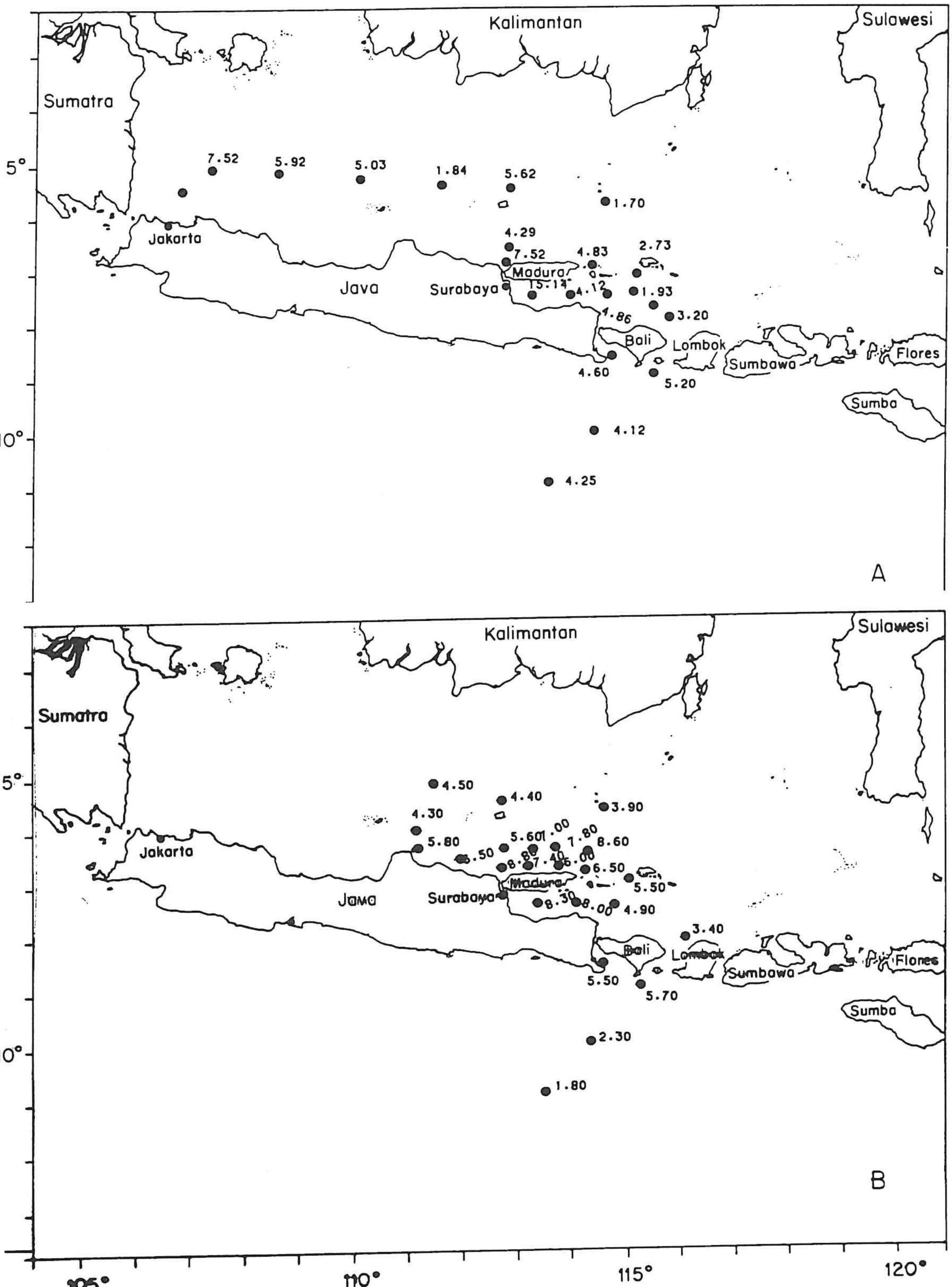


Fig 36

Concentrations of dissolved phosphate μmol.kg^{-1}.
A. First period.

po4

Madura - periode A



Java - periode B

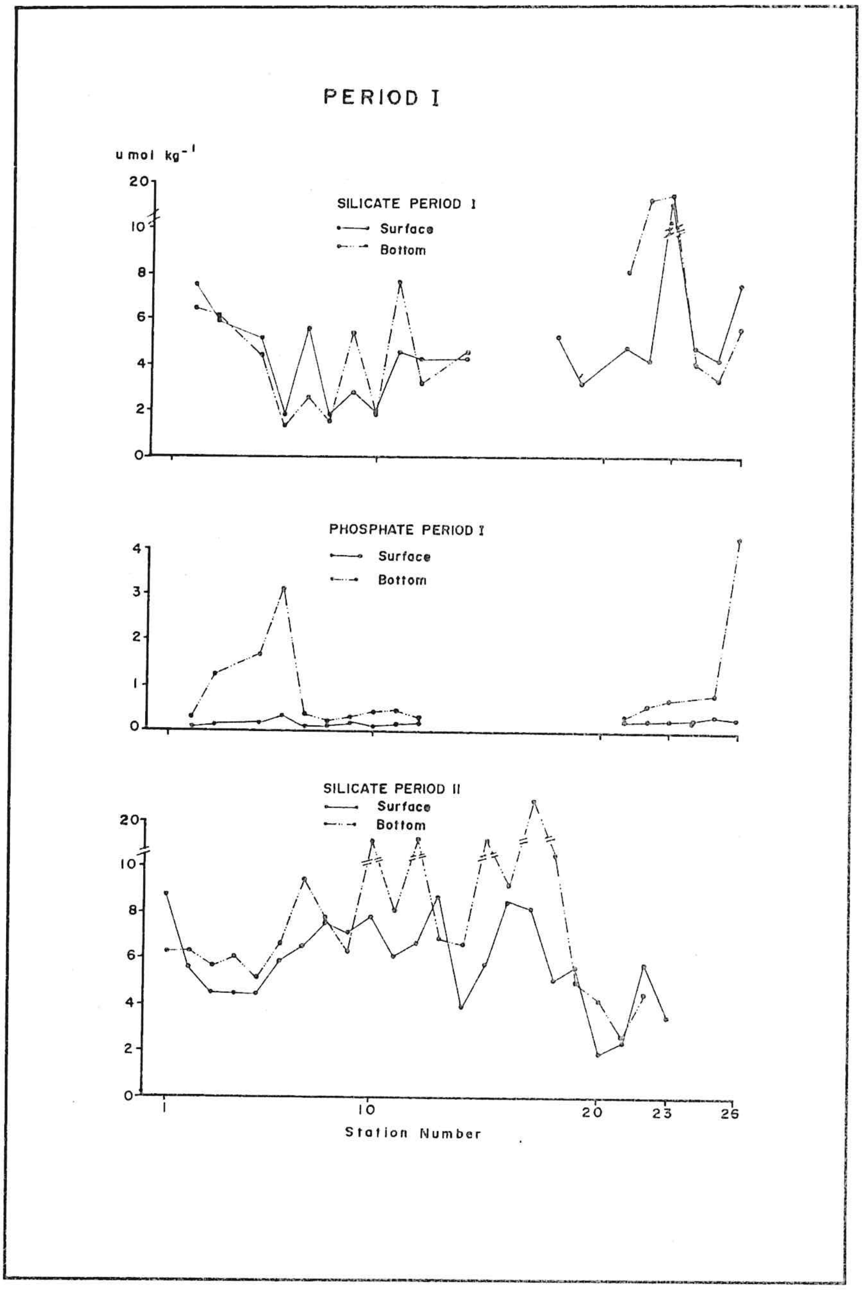


Fig 37

Concentrations of dissolved silicate and phosphate in the Java Sea and Indian Ocean. Samples from period I and II, obtained during the cruises of R.V. Tyro. (._______. surface ......bottom).

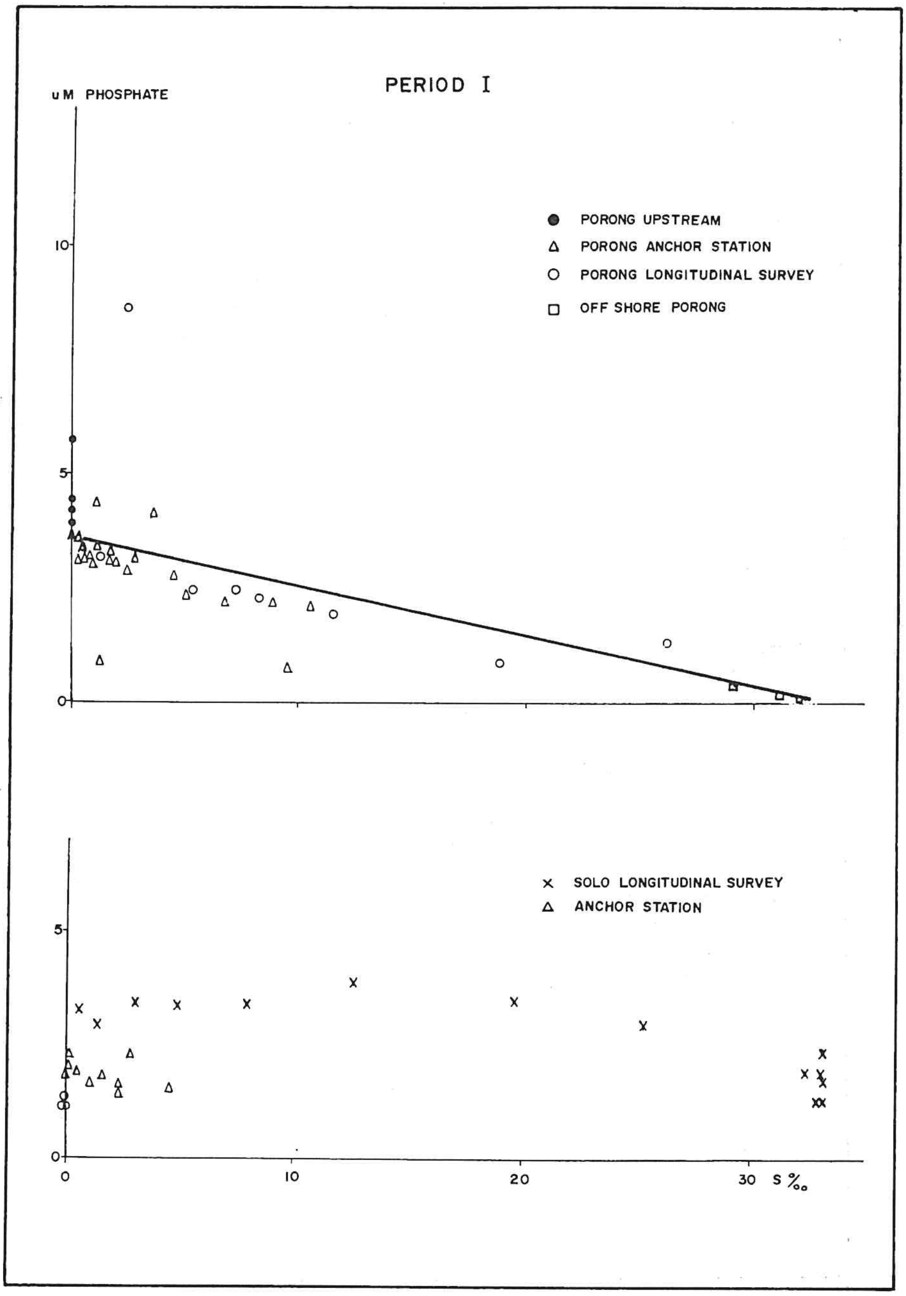


Fig 38

Plot of dissolved phosphate (μM) against salinity in the rivers Porong and Solo. First period.

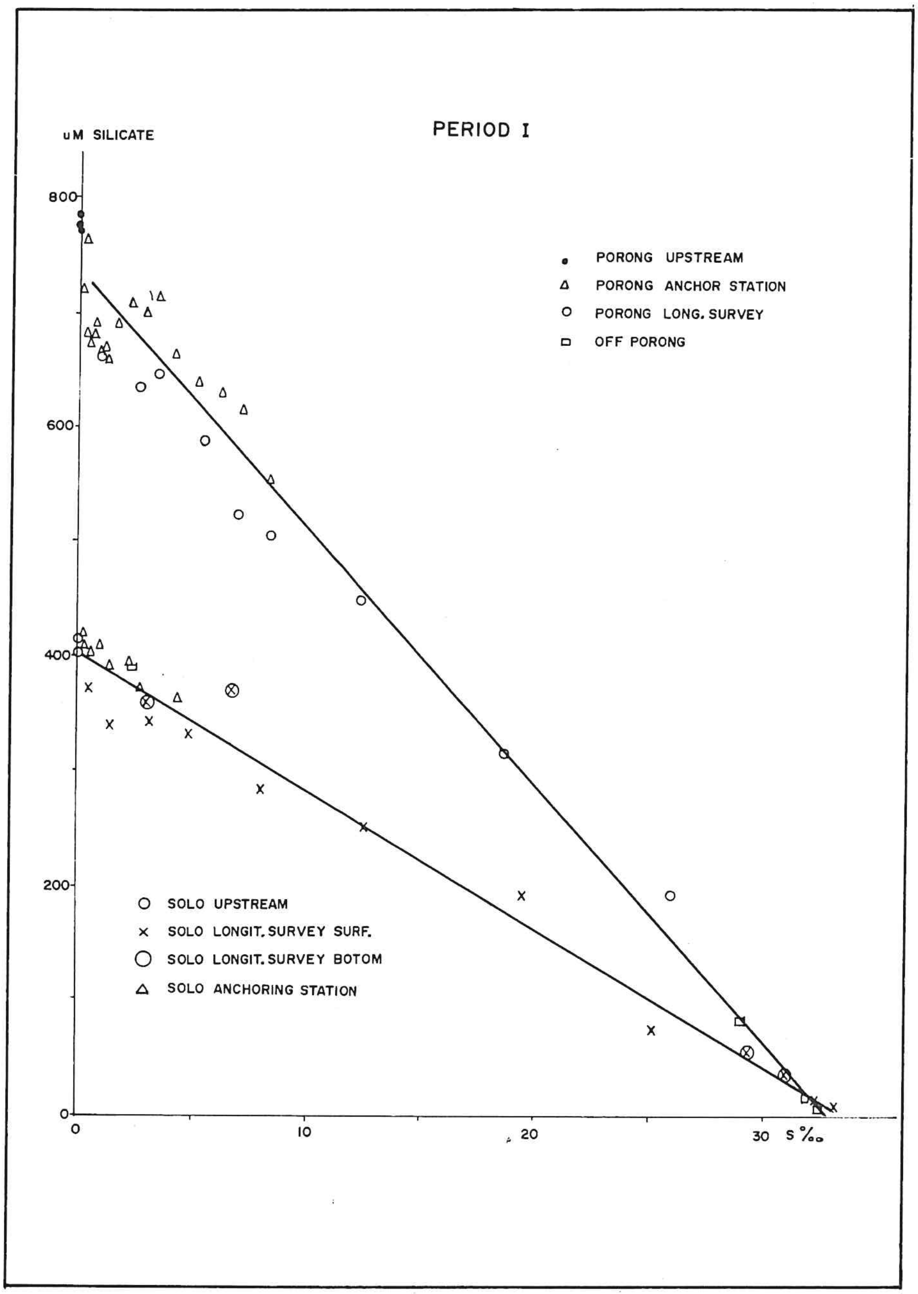
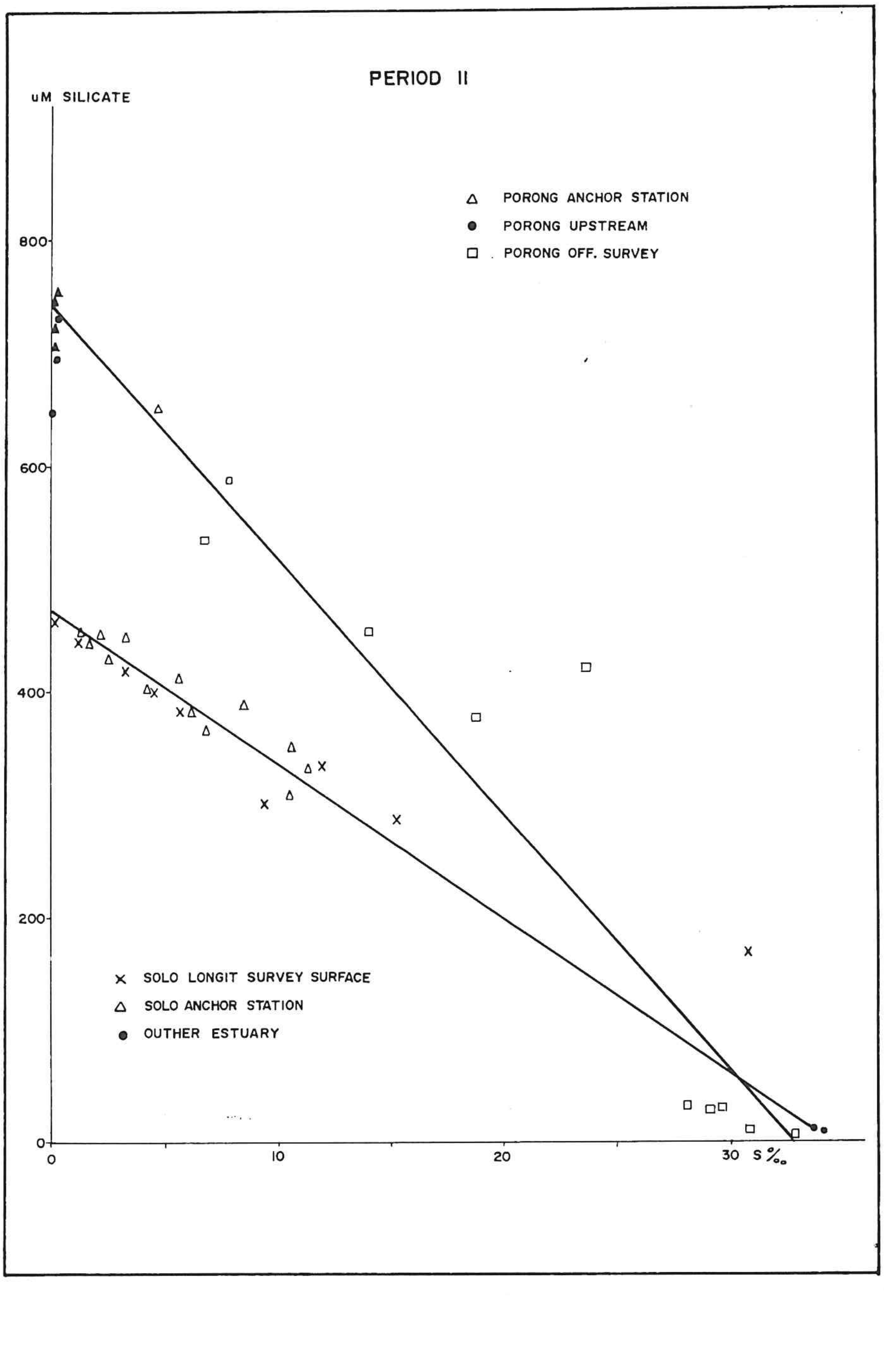


Fig 39

Plot of dissolved silicate (μM) against salinity in the rivers Porong and Solo. First and second period.


PERIOD II
uM SILICATE
800
600
400
200
0
0
10
20
30 S ‰
PORONG ANCHOR STATION
PORONG UPSTREAM
PORONG OFF. SURVEY
SOLO LONGIT SURVEY SURFACE
SOLO ANCHOR STATION
OUTHER ESTUARY

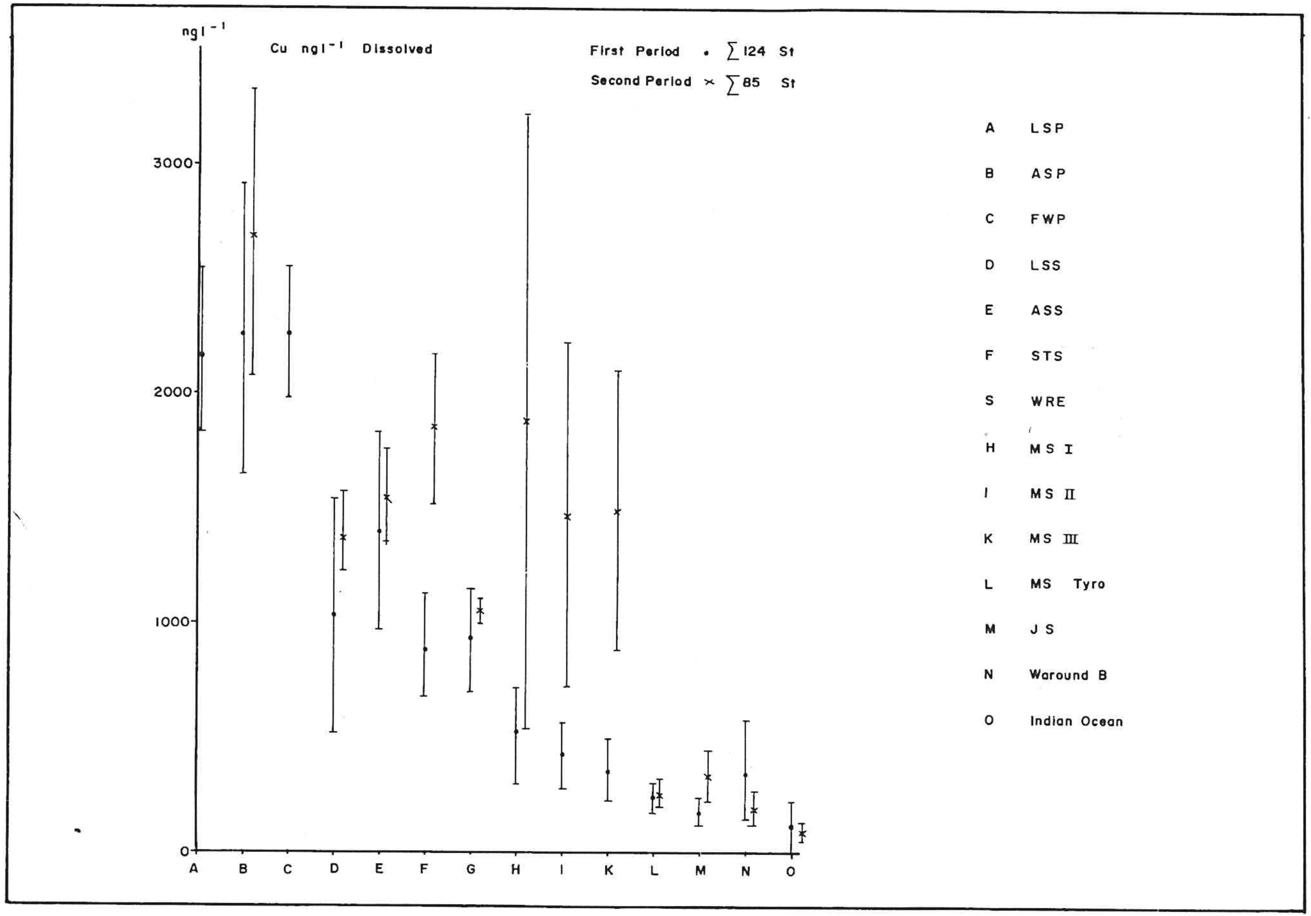
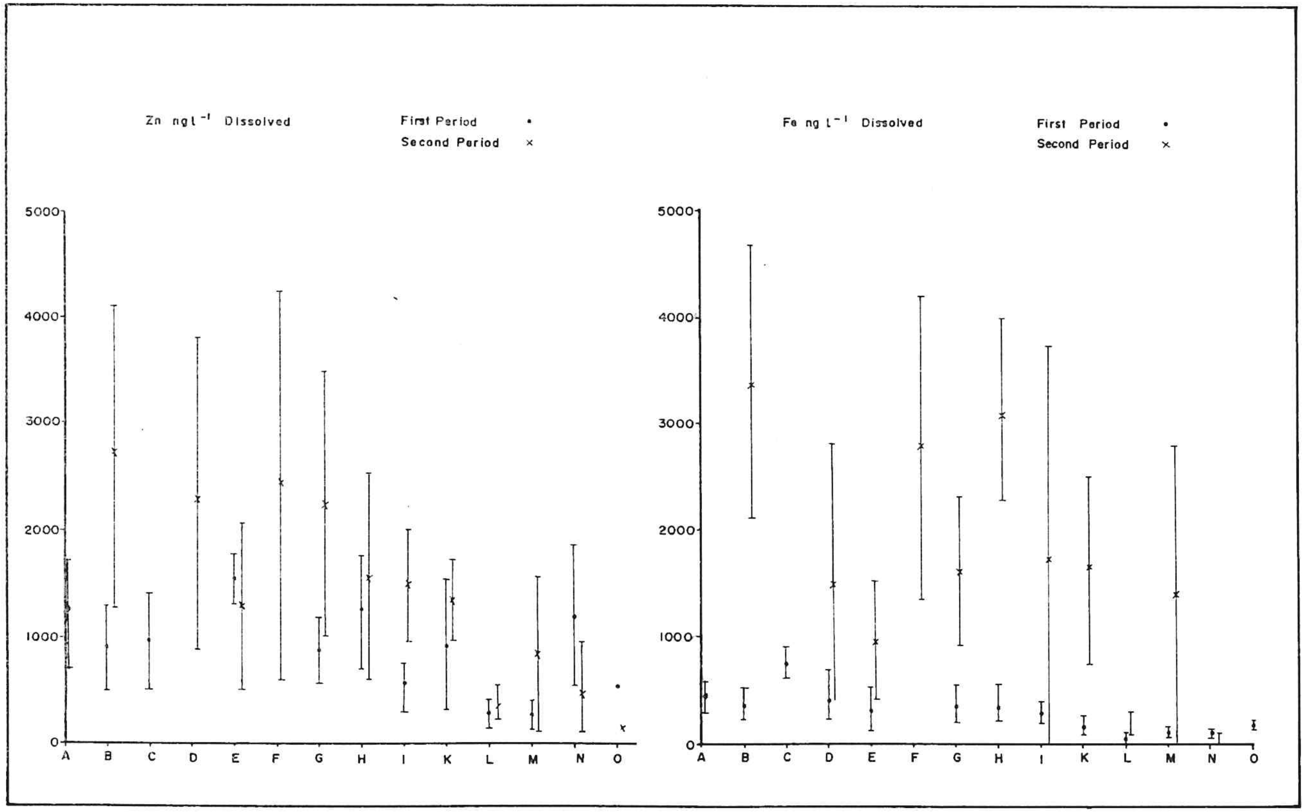
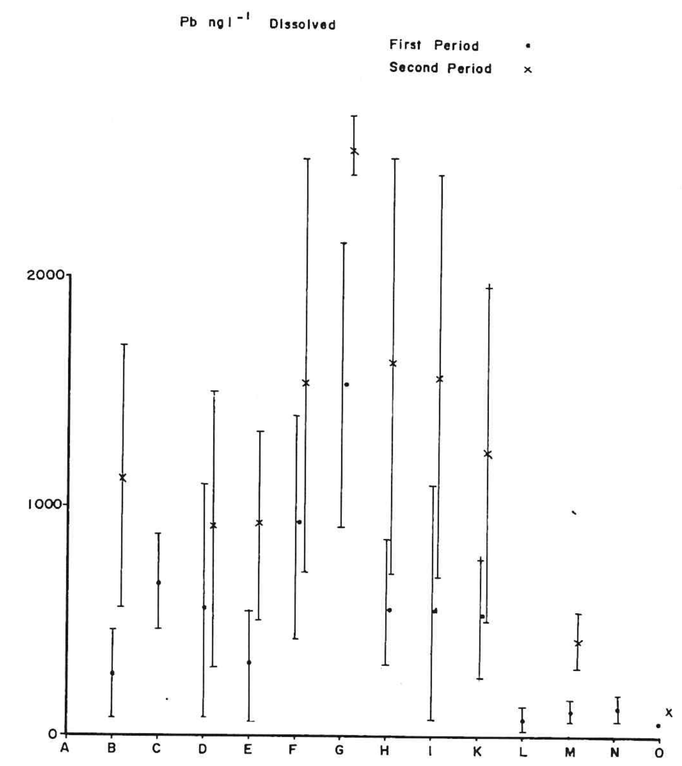


Fig 40

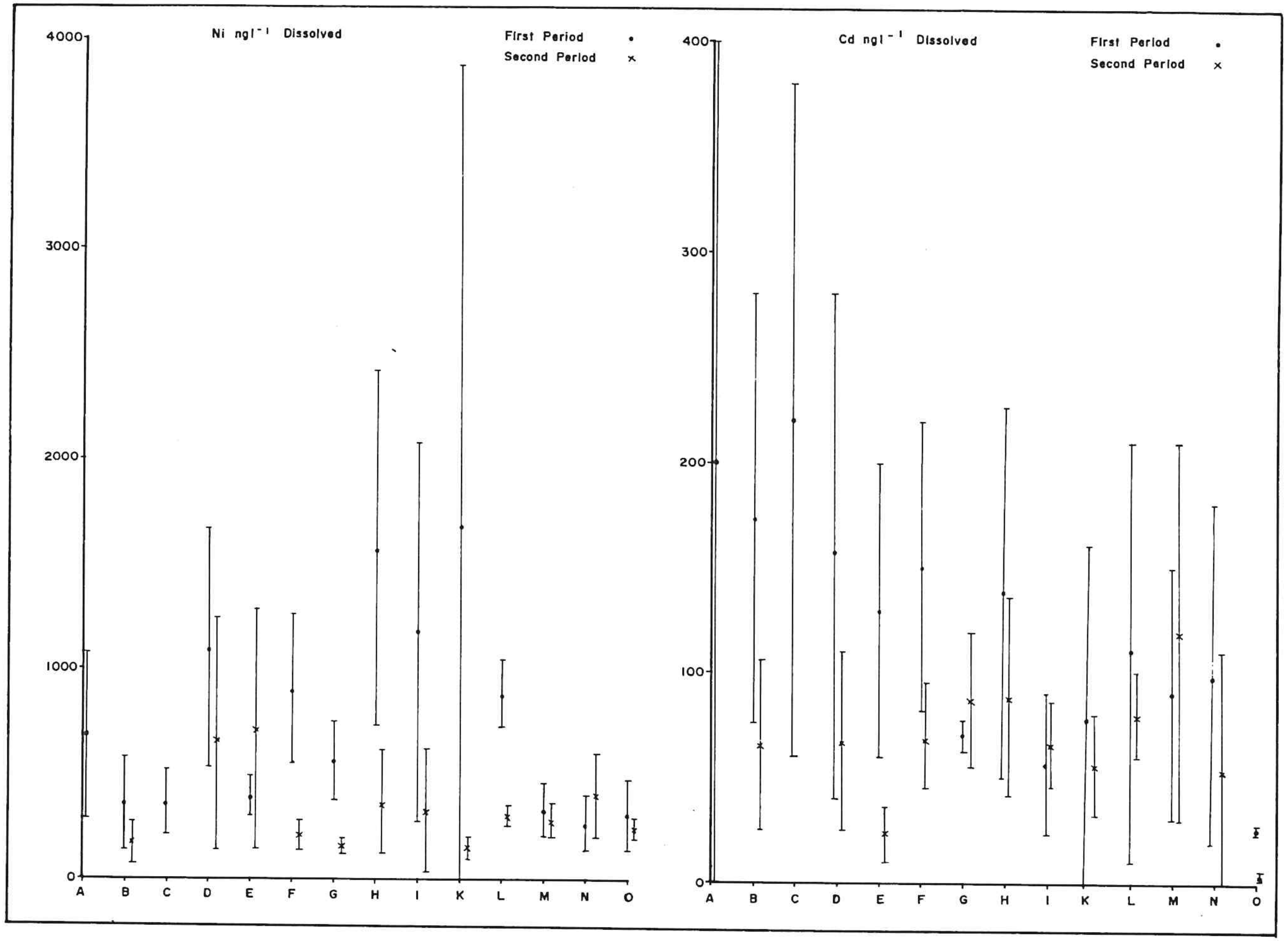
Mean concentrations (ng.1-1) and range; of dissolved Cu, Zn, Ni, Cd, Pb and Fe in the different sampling regions. For explanation see text.



Zn ng l⁻¹ Dissolved
First Period •
Second Period ×
5000
4000
3000
2000
1000
0
A B C D E F G H I K L M N O
Fe ng l⁻¹ Dissolved
First Period •
Second Period ×
5000
4000
3000
2000
1000
0
A B C D E F G H I K L M N O



Pb ng l⁻¹ Dissolved
First Period •
Second Period x
2000
1000
0
A
B
C
D
E
F
G
H
I
K
L
M
N
O



Ni ngl⁻¹ Dissolved
First Period •
Second Period ×
4000
3000
2000
1000
0
A B C D E F G H I K L M N O
Cd ngl⁻¹ Dissolved
First Period •
Second Period ×
400
300
200
100
0
A B C D E F G H I K L M N O

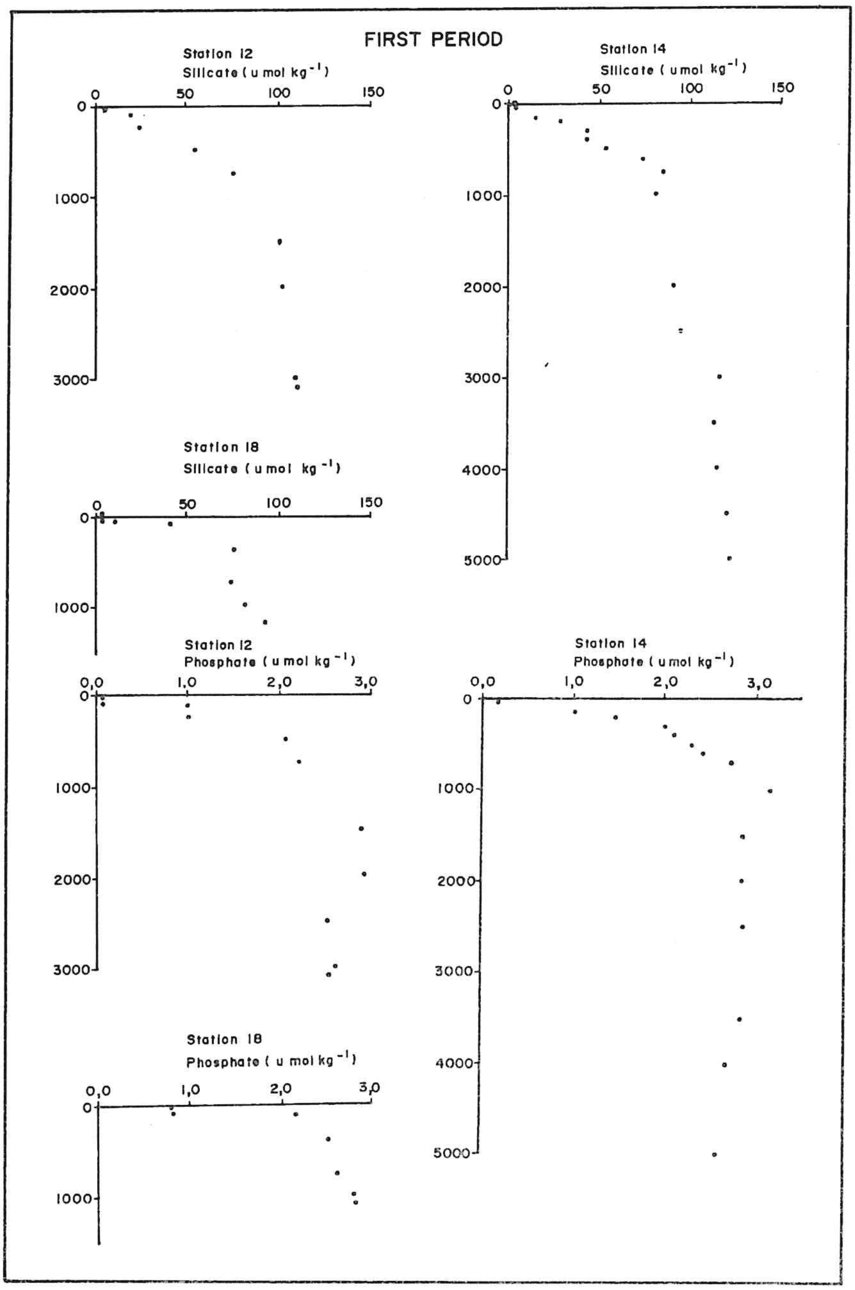
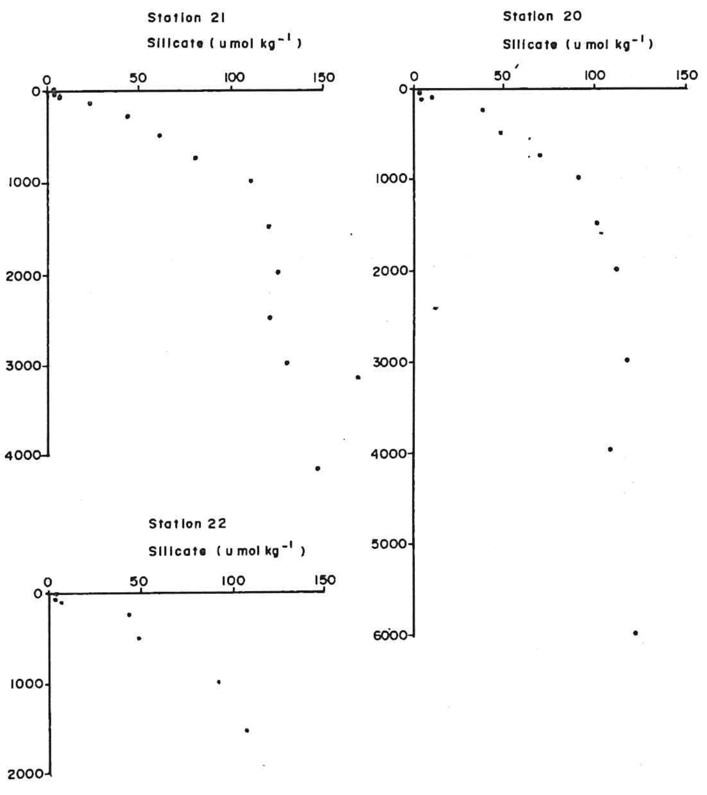


Fig 41

Silicate and phosphate profiles stations 12, 14 and 18 and silicate: stations 20, 21 and 22.

SECOND PERIOD



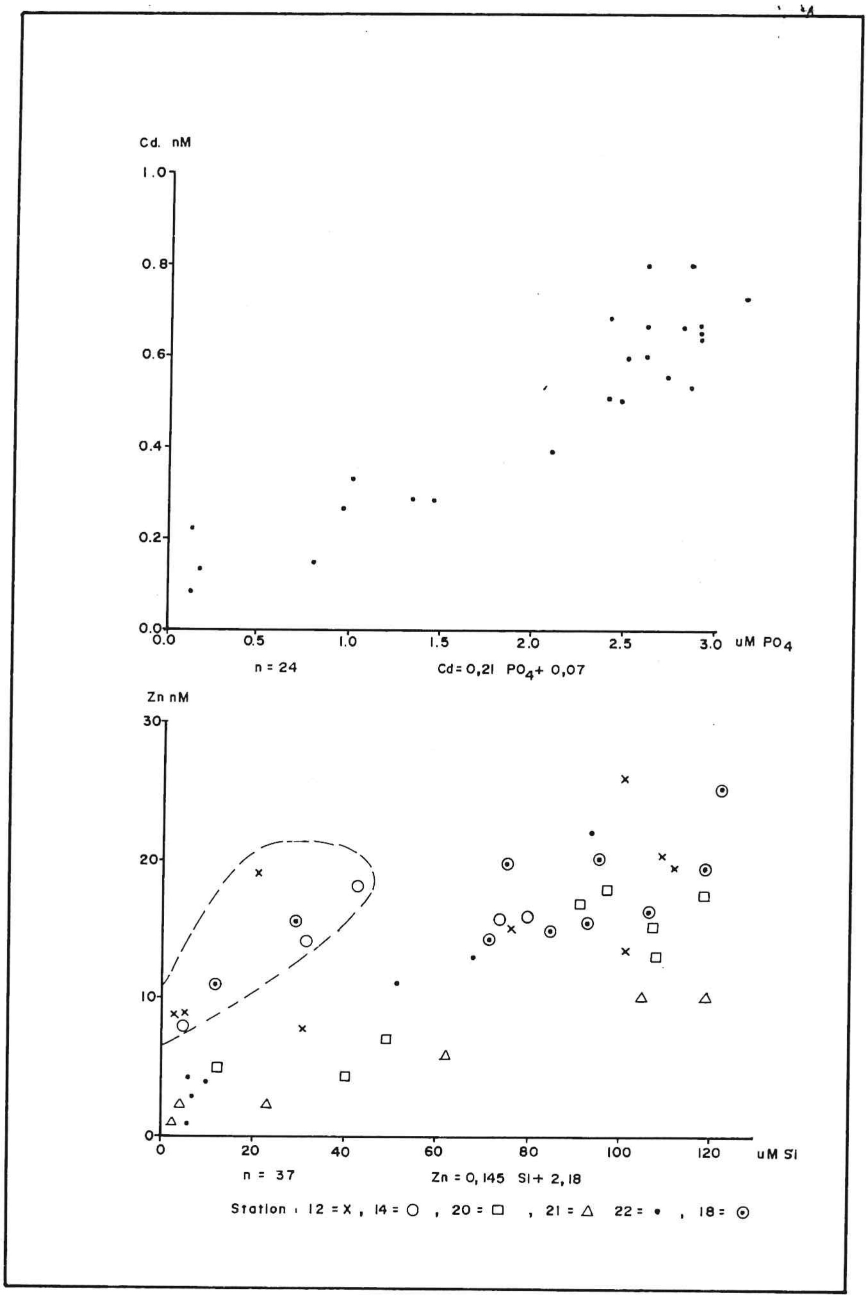


Fig 42

Relation between Cd and P (stations 12, 14 and 18) and relation between Zn and Si (stations, 12, 14, 18 - first period and 20, 21, 22 second period).

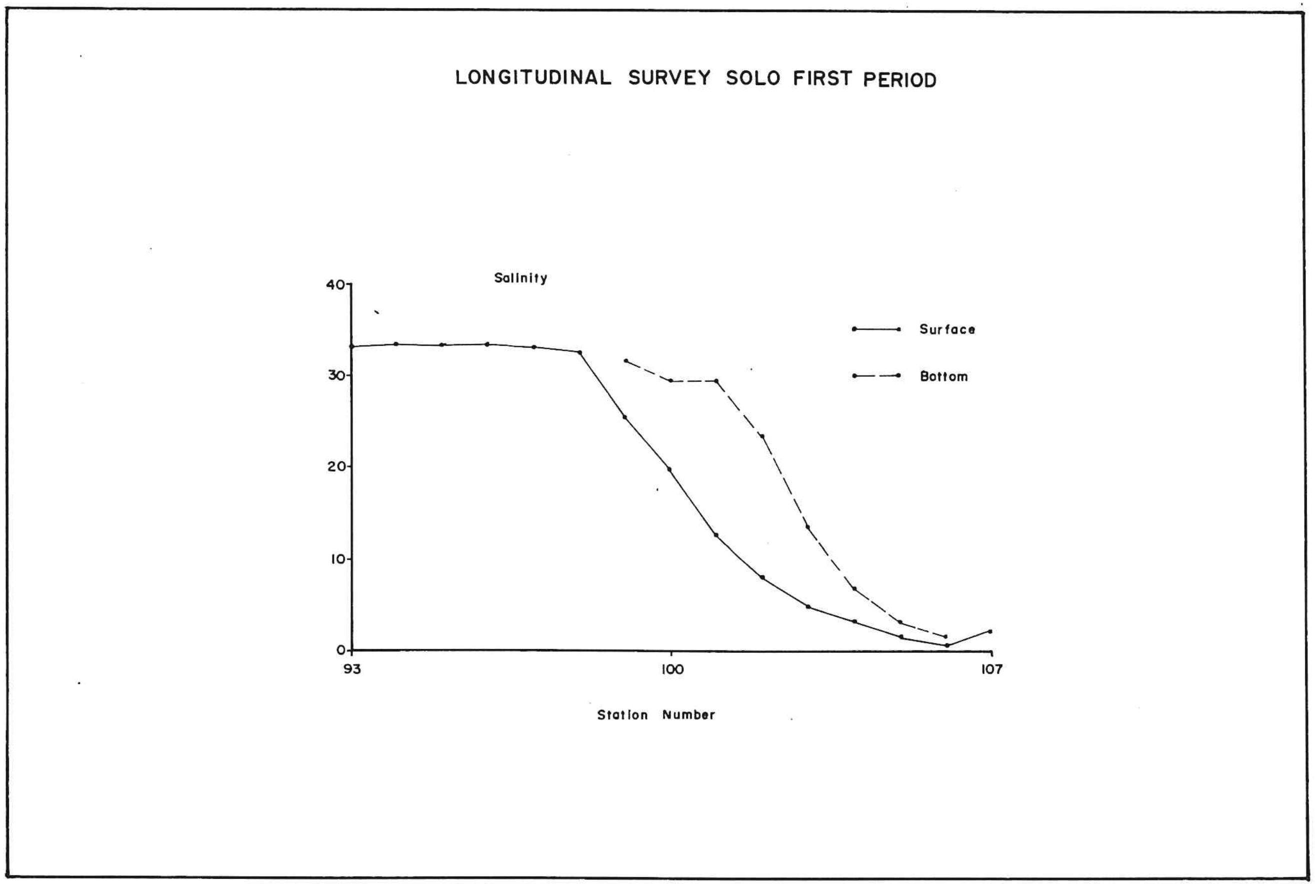


Fig 43

Salinity in the longitudinal survey of river Solo (----) surface and bottom (----).

Table I
Mean concentrations and variability of dissolved Cu, Ni, Cd, Zn, Fe and Pb in the different regions A-N. (see text), in $ng.kg^{-1}$

A Longitudinal Survey Porong

	First Period		Second Period
Cu	2188 ± 364	n=13	Cu
Ni	684 ± 392	n=13	Ni
Cd	200 ± 199	n=13	Cd
Zn	1215 ± 521	n=13	Zn
Fe	4033 ± 1841	n=12	Fe
Pb			Pb

B Anchor Station Porong

First Period			Second Period		
Cu	2273 ± 635	n=18	Cu	2699 ± 615	n=12
Ni	359 ± 222	n=18	Ni	153 ± 82	n=10
Cd	173 ± 106	n=18	Cd	65 ± 41	n=12
Zn	899 ± 400	n=18	Zn	2740 ± 1400	n=12
Fe	3878 ± 1245	n=18	Fe	33900 ± 13050	n=12
Pb	269 ± 193	n= 6	Pb	1135 ± 579	n=11

C Fresh Water Porong

Cu	2268 ± 282	n=4
Ni	363 ± 155	n=4
Cd	221 ± 159	n=4
Zn	993 ± 428	n=4
Fe	6825 ± 1857	n=4
Pb	675 ± 210	n=4

D Longitudinal Survey Solo

Cu	1028 ± 512	n=22	Cu	1396 ± 183	n=9
Ni	1090 ± 569	n=23	Ni	687 ± 544	n=9
Cd	158 ± 121	n=23	Cd	68 ± 42	n=9
Zn			Zn	2323 ± 1450	n=9
Fe	4067 ±2756	n=21	Fe	15035 ± 13000	n=9
Pb	583 ± 506	n=20	Pb	904 ± 609	n=9

Fresh Water Solo

Cu	2465
Ni	740
Cd	78
Zn	3400
Fe	29500
Pb	866

E Anchor Station Solo

Cu	1400 ± 434	n=14	Cu	1557 ± 196	n=14
Ni	393 ± 95	n=14	Ni	709 ± 575	n=13
Cd	130 ± 72	n=14	Cd	22 ± 13	n=14
Zn	1543 ± 221	n=13	Zn	1264 ± 772	n=14
Fe	3036 ± 2286	n=14	Fe	9693 ± 5571	n=14
Pb	300 ± 248	n=11	Pb	927 ± 407	n=14

F Surabaya to Solo River

Cu	879 ± 214	n=10	Cu	1848 ± 331	n=9
Ni	897 ± 348	n=10	Ni	216 ± 46	n=9
Cd	151 ± 67	n=10	Cd	69 ± 25	n=9
Zn			Zn	2424 ± 1812	n=9
Fe	20000	n=10	Fe	27967 ± 14262	n=9
Pb	922 ± 495	n= 9	Pb	1556 ± 651	n=8

G Wonokromo River Estary

Cu	926 ± 228	n=5	Cu	1043 ± 45	n=2
Ni	565 ± 180	n=5	Ni	150 ± 28	n=2
Cd	70 ± 7	n=5	Cd	89 ± 31	n=2
Zn	876 ± 301	n=5	Zn	2205 ± 1294	n=2
Fe	1533 ± 643	n=4	Fe	16250 ± 7000	n=2
Pb	1533 ± 634	n=4	Pb	2570 ± 112	n=2

H Madura Strait Track I

Cu	507 ± 209	n=7	Cu	1887 ± 1296	n=7
Ni	1570 ± 846	n=7	Ni	362 ± 247	n=7
Cd	139 ± 88	n=7	Cd	89 ± 47	n=7
Zn	1233 ± 535	n=6	Zn	1563 ± 976	n=7
Fe	3771 ± 1887	n=7	Fe	31350 ± 8775	n=6
Pb	578 ± 283	n=4	Pb	1622 ± 917	n=7

I Madura Strait Track II

Cu	418 ± 145	n=7	Cu	1471 ± 755	n=6
Ni	1184 ± 906	n=7	Ni	332 ± 295	n=6
Cd	57 ± 33	n=7	Cd	66 ± 20	n=6
Zn	540 ± 237	n=7	Zn	1492 ± 530	n=6
Fe	2957 ± 985	n=7	Fe	16817 ± 19717	n=6
Pb	584 ± 516	n=7	Pb	1573 ± 879	n=6

J Madura Strait Track III

Cu	356 ± 136	n=6		Cu	1490 ± 610	n=8
Ni	1677 ± 2203	n=6		Ni	151 ± 48	n=8
Cd	78 ± 81	n=6		Cd	56 ± 24	n=8
Zn	915 ± 623	n=6		Zn	1356 ± 382	n=8
Fe	1833 ± 804	n=6		Fe	16175 ± 8765	n=8
Pb	521 ± 265	n=6		Pb	1231 ± 742	n=8

K Madura Strait Tyro (Strait Bali)

Stations 23.22.21.24.9				Stations 12.15.16.17.		
Cu	235 ± 66	n=5		Cu	265 ± 57	n=4
Ni	875 ± 161	n=5		Ni	308 ± 36	n=4
Cd	112 ± 99	n=5		Cd	80 ± 22	n=4
Zn	274 ± 130	n=5		Zn	377 ± 168	n=4
Fe	334 ± 224	n=5		Fe	1890 ± 1192	n=3
Pb	83 ± 44	n=5		Pb		

L Java Sea

Stations 1 - 8				Stations 4.5.6.8.9.10.11.13.14.		
Cu	180 ± 61	n=7		Cu	330 ± 117	n=8
Ni	323 ± 121	n=6		Ni	283 ± 73	n=8
Cd	90 ± 57	n=7		Cd	120 ± 89	n=8
Zn	265 ± 126	n=6		Zn	838 ± 739	n=8
Fe	551 ± 376	n=7		Fe	13988 ±16196	n=8
Pb	113 ± 44	n=6		Pb	421 ± 132	n=7

M Water around Bali (Strait Lombok)

Station 20-10-11-18-19				Station 18-19-22-23		
Cu	357 ± 218	n=4		Cu	196 ± 73	n=4
Ni	267 ± 130	n=4		Ni	400 ± 199	n=4
Cd	99 ± 80	n=4		Cd	54 ± 58	n=4
Zn	1185 ± 644	n=4		Zn	428 ± 370	n=4
Fe	793 ± 297	n=4		Fe	587 ± 215	n=3
Pb	130 ± 03	n=4		Pb		

N Indian Ocean

Cu	104 ± 104	n=2		Cu	90 ± 35	n=2
Ni	309 ± 167	n=2		Ni	235 ± 35	n=2
Cd	26 ± 1,4	n=2		Cd	2 ± 1,4	n=2
Zn	764 ± 629	n=2		Zn	455 ± 516	n=2
Fe	1590 ± 127			Fe	860 ± 269	n=2
Pb				Pb	130	

Table II
Mean elemental content and variability of suspended particulate matter at the anchor stations of the rivers Solo and Porong and their chemical composition

	Anchor Station Porong				Anchor Station Solo			
	First Period	n	Second Period	n	First Period	n	Second Period	n
Al	6.96 ±0.65	22	6.21 ±1.58	7	4.97 ±0.90	13	6.86 ±0.76	10
Si	14.24 ±1.29	22	17.13 ±5.09	7	14.09 ±3.39	14	15.50 ±1.65	10
Ca	0.22 ±0.05	22	0.50 ±0.09	7	1.60 ±0.59	14	1.98 ±0.45	10
Mg	0.66 ±0.13	22	0.54 ±0.19	7	0.86 ±0.22	13	0.94 ±0.18	10
Fe	4.41 ±0.42	22	5.10 ±1.39	7	3.41 ±0.74	14	4.63 ±0.48	10
Mn	0.201±0.063	22	0.144±0.014	6	0.235±0.073	14	0.094±0.019	10
K	0.57 ±0.07	22	0.19 ±0.07	7	0.75 ±0.31	14	0.44 ±0.12	10

MnO_2	0.32%	0.23%	0.37%	0.15%
SiO_2	30.50%	36.70%	30.19%	33.21%
Al_2O_3	13.14%	11.73%	9.38%	12.95%
Fe_2O_3	6.30%	7.29%	4.88%	6.62%
MgO	1.10%	0.90%	1.43%	1.57%
CaO	0.31%	0.70%	2.24%	2.77%
K_2O	0.69%	0.22%	0.90%	0.53%

Table III
Mean ratio and range of the elements Si, Ca, Mg, Fe, Mn and K against Al in the Surabaya to Solo area. Longitudinal survey in the Solo and longitudinal survey in the Porong

Surabaya to Solo River

	First Period	n	Second Period	n
Si/Al	3.02 ± 0.80	9	2.49 ± 0.33	8
Ca/Al	0.17 ± 0.06	10	0.17 ± 0.33	8
Mg/Al	0.23 ± 0.08	10	0.18 ± 0.01	8
Fe/Al	0.69 ± 0.06	10	0.68 ± 0.02	8
Mn/Al	0.012 ± 0.002	9	0.014 ± 0.002	8
K/Al	0.13 ± 0.04	10	0.08 ± 0.005	8

Longitudinal Survey Porong

		n
Si/Al	2.03 ± 0.16	8
Ca/Al	0.032 ± 0.009	9
Mg/Al	0.13 ± 0.04	9
Fe/Al	0.65 ± 0.05	8
Mn/Al	0.037 ± 0.008	9
K/Al	0.09 ± 0.02	9

Longitudinal Survey Solo

	Surface				Bottom	
	First Period	n	Second Period	n	First Period	n
Si/Al	2.77 ±0.70	15	2.34 ±0.40	9	2.49 ±0.32	8
Ca/Al	0.34 ±0.09	15	0.41 ±0.19	9	0.28 ±0.08	8
Mg/AL	0.42 ±0.38	15	0.15 ±0.02	8	0.27 ±0.13	8
Fe/Al	0.70 ±0.10	15	0.66 ±0.05	8	0.65 ±0.03	8
Mn/Al	0.047±0.030	14	0.012±0.004	8	0.037±0.019	8
K/Al	0.19 ±0.06	15	0.08 ±0.009	8	0.12 ±0.04	8

Table IV
Chemical composition of river suspended matter (weight percentages) on an organic C-free basis. Porong and Solo values are means of the anchor stations. Data of the Zaire, Amazon and Rio Negro are from Sholkovitz et al (1978). FP=Fist Period, SP=Second Period

	Porong		Solo		Zaire	Amazone	Rio Negro
	FP	SP	FP	SP			
SiO_2	58,26	61,16	60,38	55,35	50,7	58,-	50,-
Al_2O_3	25,10	19,55	18,76	21,58	30,-	23,5	34,-
Fe_2O_3	12,03	12,15	9,76	11,03	13,6	10,5	12,6
MnO_2	0,61	0,38	0,74	0,25	0,15	0,088	0,094
CaO	0,59	1,17	4,48	4,62	0,80	1,04	0,62
MgO	2,10	1,50	2,86	2,62	1,20	1,68	0,78
K_2O	1,32	0,37	1,80	0,88	1,1	3,08	1,1

Table V
Ratios of Si, Ca, Mg, Fe, and Mn with Al in the suspended particulate matter in the rivers Porong, Solo, St. Lawrence, Varde Å, Elbe, Weser and Ems. Values from Porong and Solo are means of the anchor stations. Data from the St. Lawrence are from Gobeil et al (1981) and those from the Varde A, Elbe, Weser and Ems from Duinker et al, (1980, 1982a, 1982b, 1985). FP=First Period SP=Second Period

	Porong		Solo		St. Lawrence
	FP	SP	FP	SP	
Si/Al	2,04	2,74	2,70	2,27	3,89
Ca/Al	0,032	0,09	0,32	0,29	0,15
Mg/Al	0,095	0,109	0,19	0,14	0,14
Fe/Al	0,63	0,82	0,65	0,68	0,91
Mn/Al	0,031	0,019	0,048	0,014	0,025
K/Al	0,081	0,027	0,14	0,06	

	Varde Å	Elbe	Weser	Ems	Amazone
Si/A	3,7	5,0	3,5	4,4	2,0
Ca/A	0,06	0,6	0,40	0,9	0.022
Mg/A	0,17	0,15	0,20	0,22	0,102
Fe/A	0,80	0,70	0,85	0,82	0,42
Mn/A	0,040	0,037	0,035	0,040	0,0048
K/Al					0,190

Table VIII
Mean ratio and variablity of the elements Si, Ca, Mg, Fe, Mn and K against Al in the anchor stations of the rivers Solo and Porong

	Anchor Station Porong				Anchor Station Solo			
	First Period	n	Second Period	n	First Period	n	Second Period	n
Si/Al	2.04 ±0.16	22	2.74 ±0.35	7	2.70 ±0.37	14	2.27 ±0.19	10
Ca/Al	0.032±0.009	22	0.09 ±0.05	7	0.32 ±0.06	14	0.29 ±0.07	10
Mg/Al	0.095±0.025	22	0.109±0.103	7	0.19 ±0.09	14	0.14 ±0.03	10
Fe/Al	0.63 ±0.04	22	0.82 ±0.07	7	0.65 ±0.05	14	0.68 ±0.08	10
Ma/Al	0.031±0.009	22	0.019±0.006	7	0.048±0.019	14	0.014±0.003	10
K/Al	0.081±0.011	22	0.027±0.008	7	0.14 ±0.05	14	0.06 ±0.02	10

Table VI
Leachable fraction of the elements Cd, Zn, Pb, Cu, Mn, Cr, Fe, Ca, Al, Si, Ni, K and Mg of suspended matter obtained from the anchor stations. Data from the Elbe, Weser and Ems are from Duinker et al, (1982, 1985) FP=First Period, SP=Second Period

Leachable fraction

		Porong	Solo	Elbe	Weser	Ems
Cd	F	100	74-100	80-100	61-100	15-72
	S	80				
Zn				80-100	50-82	54-70
Cu		26-50	30-60	25-80	50-100	50-100
Pb	F	50-80	40-70	75-95	40-95	20-80
	S	40-60				
Cr	F	10-50	15-40	10-35		
	S	5-15	12-40			
Mn		100	100	90-100	80-100	82-95
Fe	F	12-21	13-25	25-42	18-40	25-40
	S	5-18	8-16			
Ca		100	100	100	100	100
Al	F	4-14	6-22	4-7	5-10	5-10
	S	4-7	2-6			
Si		0	0	0	0	0
Ni	F	20-75	30-70			
	S	20-40	55-70			
K	F	68-72	45-76			
	S	26-77				
Mg	F	65-77	40-70	28-70	40-80	30-65
	S	35-55	30-66			

Table VII
Elemental content of suspended sediment in different river systems. Porong and Solo. Range of values of the anchor stations. Zaire data after Martin et al (1978) Rhine, Duinker and Nolting (1978). Ems, Weser and Elbe, from, Duinker et al (1982a, 1982b, 1985) World rivers from Martin and Meybeck (1979)

	Porong	Solo	Zaire	Rhine	Ems	Weser	Elbe	World Rivers
Cu	50-200	50-150	100	200-400	40-80	40-80	40-60	100
Zn	100-600	200-1000	300-400	2000	200-400	400	400-500	350
Ni	20-200	50-100	54	40-60				90
Cr	20-100	100	175-211	200-400			100	100
Cd	2-60	5-20		4-8	2-4	2-4	2-4	
Pb	20-200	100-500	220		100-300	100-200	100-200	150

Table IX

Concentrations of dissolved Cu, Zn, Cd, Pb, Ni and Fe in all regions in $ng.kg^{-1}$ and $nmol.kg^{-1}$.

			Cu		Ni		Cd	
STATION	DEPTH	SAL.	ng/l	nmol/l	ng/l	nmol/l	ng/l	nmol/l
2	0	31.49	215	3.38	427	7.27	115	1.02
	45	31.50	245	3.86	556	9.47	161	1.43
3	0	31.65	169	2.66	212	3.61	75	.67
	40	31.69	298	4.69	1073	18.28	99	.88
5	0	32.40	300	4.72	363	6.18	158	1.41
	40	32.42	556	8.75	363	6.18	175	1.56
6	0	33.39	147	2.31	212	3.61	33	.29
	63	33.39	397	6.25	406	6.92	152	1.35
7	0	33.70	139	2.19	234	3.99	59	.52
	66	33.72	275	4.33	556	9.47	229	2.04
8	0	33.95	116	1.83	1632	27.80	25	.22
	70	33.97	571	8.99	1654	28.17	162	1.44
9	0	33.65	147	2.31	965	16.44	286	2.54
	77	33.82	510	8.03	1051	17.90	252	2.24
10	0	33.54	404	6.36	449	7.65	148	1.32
	60	33.73	586	9.22	2815	47.95	177	1.57
	110	34.49	510	8.03	1482	25.24	140	1.25
11	0	33.43	601	9.46	212	3.61	186	1.65
	24	34.13	86	1.35	126	2.15	10	.09
12	0	33.86	30	.47	191	3.25	25	.22
	25	33.99	109	1.72	513	8.74	9	.08
	100	34.58	154	2.42	1955	33.30	37	.33
	250	34.59	89	1.40	450	7.66	29	.26
	500	34.72	122	1.92	430	7.32	179	1.59
	750	34.63	177	2.79	535	9.11	115	1.02
	1500		222	3.49	815	13.88	74	.66
	2000		230	3.62	922	15.70	73	.65
	2500		124	1.95	556	9.47	56	.50
	3000		245	3.86	944	16.08	68	.60
	3100		351	5.52	858	14.61	78	.69
14	0		177	2.79	427	7.27	27	.24
	50		298	4.69	126	2.15	15	.13
	150							
	200		94	1.48	126	2.15	31	.28
	300							
	400		859	13.52	234	3.99	44	.39
	500							
	600		162	2.55	191	3.25	57	.51
	750		169	2.66	470	8.01	62	.55
	1000		222	3.50	255	4.34	82	.73
	1500		707	11.13	492	8.38	60	.53
	2000							
	2500		450	7.08	772	13.15	75	.67
	3000							
14	3500		169	2.66	212	3.61	90	.80
	4000							
	4500		245	3.86	330	5.62	87	.77
	5000		245	3.86	298	5.08	90	.80
18	0		351	5.52	260	4.43	50	.44
	50		949	14.94	168	2.89	16	.14
	100							
	250		211	3.32	191	3.25	32	.28
	400		378	5.95	309	5.26	68	.60
	750		239	3.76	298	5.08	75	.67
	1000		128	2.01	320	5.45	132	1.17
	1200		122	1.92	320	5.45	74	.66
19	0		72	1.13	148	2.52	15	.13
21	0	32.54	200	3.15	642	10.94	46	.41

STATION	DEPTH	SAL.	Cu ng/l	Cu nmol/l	Ni ng/l	Ni nmol/l	Cd ng/l	Cd nmol/l
	90	34.51	245	3.86	2170	36.96	71	.63
22	0	32.03	268	4.22	1073	18.28	75	.67
	53	33.46	230	3.62	879	14.97	70	.62
23	0	31.71	321	5.05	836	14.24	66	.59
	40	33.33	321	5.05	1245	21.21	71	.63
24	0	32.63	238	3.75	858	14.61	85	.76
	60	33.47	207	3.26	836	14.24	25	.22
25	0	32.09	677	10.65	492	8.38	124	1.10
	45	33.61	578	9.10	1137	19.37	99	.88
26	0	32.37	419	6.59	320	5.45	70	.62
	17	33.25	556	8.75	535	9.11	163	1.45
5/2/1	0	26.01	1983	31.21	1417	24.14	310	2.76
5/2/2	0	18.80	1720	27.07	1116	19.01	50	.44
5/2/3	0	11.70	1895	29.82	363	6.18	144	1.28
5/2/4	0	8.30	2421	38.10	772	13.15	61	.54
5/2/5	0	7.03	2465	38.97	578	9.85	158	1.41
5/2/6	0	5.50	1939	30.52	750	12.77	66	.59
5/2/7	0	3.50	2596	40.87	1374	23.40	443	3.94
5/2/8	0	2.50	2290	36.04	470	8.01	743	6.61
5/2/9	0	1.19	2158	33.96	664	11.31	43	.38
5/2/10	0	.70	2947	46.38	384	6.54	171	1.52
5/2/11	0	.17	2377	37.41	406	6.92	186	1.65
5/2/12	0	.24	1895	29.82	234	3.99	158	1.40
5/2/13	0	.50						
5/2/14	0	1.69	1764	27.76	363	6.18	71	.63
5/2/15	0	1.85						
5/2/16	0	1.18	1807	28.44	191	3.25	55	.49
5/2/17	0	1.14						
5/2/18	0	.67	1807	28.44	169	2.88	148	1.32
5/2/19	0	.86						
5/2/20	0	.83	1720	27.06	212	3.61	90	.80
5/2/21	0	.65	2575	40.53	212	3.61	176	1.57
5/2/22	0	1.45	2296	36.13	556	9.47	86	.77
5/2/23	0	7.89	2296	36.13	492	8.38	147	1.31
5/2/24	0	10.83	2352	37.02	729	12.42	158	1.41
5/2/25	0	9.50	2184	34.37	965	16.44	126	1.12
5/2/26	0	7.36	2408	37.90	492	8.38	221	1.97
5/2/27	0	6.75	2240	35.25	169	2.88	140	1.25
5/2/28	0	5.42	2184	34.37	169	2.88	113	1.01
5/2/29	0	4.52	2184	34.37	212	3.61	118	1.05
5/2/30	0	3.85	2296	36.13	191	3.25	155	1.38
5/2/31	0	2.90	2305	36.28	413	7.03	486	4.32
5/2/32	0	2.61	4621	72.73	380	6.47	200	1.78
5/2/33	0	1.18	1994	31.38	213	3.62	395	3.51
5/2/34	0	.86	1758	27.67	380	6.47	176	1.57
5/2/35	0	.58	1926	30.31	314	5.35	130	1.16
5/2/37	0		2642	41.58	380	6.47	150	1.33
5/2/39	0		2179	34.29	248	4.22	111	.99
5/2/40	0		2284	35.95	577	9.83	167	1.49
5/2/41	0		1968	30.97	248	4.22	457	4.07
5/2/42	0	31.96	874	13.76	874	14.89	181	1.61
5/2/43	0	31.93	663	10.43	1137	19.37	159	1.41
5/2/44	0	31.98	410	6.45	2849	48.53	161	1.43
5/2/45	0	32.13	368	5.79	1796	30.59	117	1.04
5/2/46	0	32.08	579	9.11	2191	37.32	286	2.54
5/2/47	0	32.01	284	4.47	1796	30.59	21	.19
5/2/48	0	32.08	368	5.79	347	5.91	50	.44

STATION	DEPTH	SAL.	Cu ng/l	Cu nmol/l	Ni ng/l	Ni nmol/l	Cd ng/l	Cd nmol/l
5/2/49	0	32.01	621	9.77	446	7.60	110	.98
5/2/50	0	31.88	579	9.11	775	13.20	72	.64
5/2/51	0	31.63	410	6.45	248	4.22	27	.24
5/2/52	0	31.90	410	6.45	479	8.16	77	.69
5/2/53	0	32.05	410	6.45	2487	42.36	62	.55
5/2/54	0	31.95	284	4.47	2059	35.07	17	.15
5/2/55	0	32.00	215	3.38	1796	30.59	34	.30
5/2/56	0	31.18	554	8.72	413	7.03	33	.29
5/2/57	0	31.50	469	7.38	347	5.91	32	.29
5/2/58	0	31.80	342	5.38	2948	50.21	20	.18
5/2/59	0	31.80	342	5.38	5648	96.20	21	.19
5/2/60	0	32.01	215	3.38	448	7.63	154	1.37
5/2/61	0	32.42	215	3.38	259	4.41	206	1.84
5/2/62	0	31.30	808	12.72	276	4.70	71	.63
5/2/64	0	26.80	1232	19.39	655	11.16	77	.69
5/2/66	0	23.00	1062	16.71	690	11.75	61	.54
5/2/68	0	31.40	639	10.06	505	8.60	64	.57
5/2/70	0	27.00	893	14.05	701	11.94	75	.66
5/2/71	0	31.80	596	9.38	372	6.34	105	.94
5/2/73	0	29.00	1317	20.73	536	9.13	138	1.23
5/2/83	0		978	15.39	1062	18.09	90	.80
5/2/84	0		766	12.06	1490	25.38	94	.84
5/2/85	0	31.92	893	14.05	1227	20.90	190	1.69
5/2/86	0	31.95	978	15.39	635	10.82	208	1.86
5/2/87	0	31.95	766	12.05	569	9.70	281	2.51
5/2/88	0	31.90	978	15.39	767	13.06	81	.72
5/2/89	0	31.90	978	15.39	569	9.69	148	1.32
5/2/90	0	31.88	1359	21.39	1325	22.59	191	1.70
5/2/91	0	32.03	681	10.72	635	10.82	75	.67
5/2/92	0		596	9.38	668	11.38	150	1.34
5/2/93	0	32.95	512	8.06	635	10.82	162	1.45
5/2/94	0	33.10	258	4.06	602	10.25	179	1.60
5/2/95	0	33.15	512	8.06	898	15.30	375	3.34
5/2/96	0	33.19	554	8.72	602	10.25	212	1.89
5/2/97	0	33.14	554	8.72	2311	39.36	64	.57
5/2/98	0	32.24			306	5.21	8	.07
5/2/99	0	25.12	851	13.39	1030	17.54	235	2.09
5/2/99B		31.18	766	12.06	1457	24.82	567	5.04
5/2/100	0	19.83	978	15.39	1030	17.54	77	.69
5/2/100B		29.46	1020	16.05	2081	35.45	133	1.18
5/2/101	0	12.52	1105	17.39	1194	20.34	67	.60
5/2/101B		29.34	893	14.05	1260	21.46	121	1.08
5/2/102	0	7.97	935	14.72	2109	35.92	77	.69
5/2/102B		23.13	1062	16.71	1926	32.81	73	.65
5/2/103	0	4.85	1359	21.39	672	11.42	163	1.45
5/2/103B		13.22	1105	17.39	1528	26.03	220	1.96
5/2/104	0	3.10	1317	20.73	1070	18.23	220	1.96
5/2/104B		6.88	1190	18.73	794	13.52	217	1.93
5/2/105	0	1.46	1190	18.73	1070	18.23	87	.77
5/2/105B		3.08	1147	18.05	733	12.49	60	.53
5/2/106	0	.47	1147	18.05	580	9.88	129	1.15
5/2/106B			1274	20.05	794	13.52	133	1.18
5/2/107	0	2.69	2884	45.39	397	6.76	63	.56
5/2/108	0	2.30	1190	18.73	336	5.72	53	.47
5/2/109	0	2.30	1247	19.63	458	7.80	107	.95
5/2/110	0	1.50	2122	33.40	397	6.76	83	.74

STATION	DEPTH	SAL.	Cu ng/l	Cu nmol/l	Ni ng/l	Ni nmol/l	Cd ng/l	Cd nmol/l
5/2/111	0	.18	1571	24.72	519	8.84	177	1.57
5/2/112	0	.19	1783	28.06	244	4.16	220	1.96
5/2/113	0	.18	1232	19.39	336	5.72	277	2.46
5/2/114	0	.18	2206	34.72	397	6.76	67	.60
5/2/115	0	.18	1190	18.73	397	6.76	180	1.60
5/2/116	0	.18	1062	16.71	275	4.68	160	1.42
5/2/117	0	.18	1910	30.06	550	9.37	205	1.82
5/2/118	0		1105	17.39	397	6.76	100	.89
5/2/119	0	.52	1020	16.05	397	6.76	50	.44
5/2/120	0	1.00	935	14.72	275	4.68	60	.53
5/2/121	0	4.40	1020	16.05	519	8.84	80	.71
5/2/122	0		1359	21.39	213	3.63	33	.29
5/2/123	0		1867	29.38	764	13.01	53	.47
5/2/124A	0		2465	38.79	740	12.60	78	.69
5/2/124B	0							
5/2/124C	0							
5/3/2001	0	.22	1389	21.86	250	4.26	44	.39
5/3/2002	0	1.26	1791	28.19	620	10.56	47	.42
5/3/2003	0	3.30	1252	19.70	320	5.45	13	.12
5/3/2004	0	4.50	1546	24.33	580	9.88	87	.77
5/3/2005	0	5.78	1350	21.25	500	8.52	162	1.44
5/3/2006	0	9.18	1340	21.09	660	11.24	75	.67
5/3/2007	0	12.00	1438	22.63	710	12.10	69	.61
5/3/2008	0	15.22	1281	20.16	2080	35.43	44	.39
5/3/2009	0	33.50	1173	18.46	460	7.84	75	.67
5/3/2010	0	4.70	1438	22.63	420	7.16	25	.22
5/3/2011	0	3.30	1369	21.55	320	5.45	41	.36
5/3/2012	0	2.05	1408	22.16	220	3.74	19	.17
5/3/2013	0	1.42	1418	22.32	1820	31.00	10	.09
5/3/2014	0	1.66	1546	24.33	2000	34.00	13	.12
5/3/2015	0	5.70	1399	22.02	1480	25.20	3	.03
5/3/2016	0	8.60	1320	20.77	1300	22.15	41	.36
5/3/2017	0	10.60	1634	25.72	1040	17.75	13	.12
5/3/2018	0	11.30	1350	21.25	1230	20.95	19	.17
5/3/2019	0	10.50	1830	28.80	290	4.94	22	.20
5/3/2020	0	6.90	1771	27.87	290	4.94	47	.42
5/3/2021	0	6.12	1703	26.80	230	3.92	16	.14
5/3/2022	0	4.17	1890	29.75	230	3.92	22	.20
5/3/2023	0	2.52	1722	27.10	350	5.96	10	.09
5/3/2024	0	32.08	1788	28.14	260	4.43	44	.39
5/3/2025	0	32.16	2219	34.92	260	4.43	62	.55
5/3/2027	0	32.35	2469	38.86	200	3.41	53	.47
5/3/2028	0	32.43	2021	31.81	230	3.91	78	.69
5/3/2029	0	32.75	1808	28.45	290	4.94	103	.92
5/3/2030	0	32.75	1645	25.89	180	3.07	76	.86
5/3/2031	0	32.88	1438	22.63	180	3.07	38	.34
5/3/2032	0	32.85	1688	26.57	180	3.07	108	.96
5/3/2033	0	32.80	1557	24.50	160	2.73	58	.52
5/3/2034	0	.15	2642	41.58	2060	35.09	106	.94
5/3/2035	0	.15	2460	38.72	180	3.07	53	.47
5/3/2036	0	.15	2126	33.46	90	1.53	29	.26
5/3/2037	0	.14	2038	32.07	1110	18.91	29	.26
5/3/2038	0	.13	2156	33.93	140	2.39	31	.28
5/3/2039	0	.14	2913	45.85	90	1.53	31	.28
5/3/2040	0	.14	2591	40.78	220	3.75	114	1.01
5/3/2041	0	.14	3449	54.28	350	5.96	131	1.17
5/3/2042	0	.14	2722	42.84	95	1.62	100	.89

STATION	DEPTH	SAL.	Cu ng/l	Cu nmol/l	Ni ng/l	Ni nmol/l	Cd ng/l	Cd nmol/l
5/3/2043	0	.14	3568	56.15	155	2.64	92	.82
5/3/2044	0	.14	1960	30.85	95	1.62	32	.28
5/3/2045	0	.14	3757	59.13	110	1.87	26	.23
5/3/2047	0		2271	35.74	490	8.35	44	.39
5/3/2048	0		1982	31.19	310	5.28	42	.37
5/3/2049	0		1982	31.19	155	2.64	90	.80
5/3/2050	0	31.75	2384	37.52	100	1.70	58	.52
5/3/2051	0		2352	37.02	110	1.87	75	.67
5/3/2052	0		2025	31.87	155	2.64	92	.82
5/3/2053	0		2177	34.26	180	3.07	3	.03
5/3/2054	0		2036	32.04	240	4.09	83	.74
5/3/2055	0		4532	71.33	120	2.04	105	.93
5/3/2056	0	30.55	2211	34.80	195	3.32	54	.48
5/3/056A	0		981	15.44	110	1.87	38	.34
5/3/2057	0	31.75	710	11.17	110	1.87	32	.28
5/3/2061	0		1074	16.90	170	2.90	111	.99
5/3/2062	0		1011	15.91	130	2.21	67	.60
5/3/2063	0		1032	16.24	120	2.04	50	.44
5/3/2064	0	32.22	1448	22.79	220	3.75	106	.94
5/3/2065	0		742	11.68	130	2.21	50	.44
5/3/2066	0	33.35	700	11.02	240	4.09	36	.32
5/3/2067	0	33.00	825	12.98	160	2.72	181	1.61
5/3/2068	0	32.80	3441	54.15	840	14.31	75	.67
5/3/2069	0	32.40	1780	28.01	350	5.96	86	.77
5/3/2070	0	32.27	4022	63.30	520	8.86	92	.82
5/3/2071	0	31.80	1697	26.71	300	5.11	100	.89
5/3/2072	0	32.97	1344	21.15	120	2.04	94	.84
5/3/2073	0	33.60	1157	18.21	120	2.04	44	.39
5/3/2074	0	29.80	1344	21.15	590	10.05	61	.54
5/3/2075	0	31.20	1198	18.85	180	3.07	67	.60
5/3/2076	0	32.70	825	12.98	170	2.90	44	.39
5/3/072A	0							
5/3/073A	0							
5/3/074A	0							
5/3/075A	0							
5/3/076A	0							
5/3/2077	0	32.60	2963	46.63	810	13.80	83	.74
5/3/071C	0	31.70						
5/3/077A	0							
5/3/2078	0	33.63	1198	18.85	150	2.56	42	.37
5/3/2079	0	31.69	1032	16.24	110	1.87	72	.64
5/3/2080	0	31.30	1904	29.97	200	3.41	31	.28
5/4/1	0	33.41	1258	19.80	710	12.10	233	2.07
5/4/1	43	33.79	238	3.75	300	5.11	50	.44
5/4/2	0	33.76	2690	42.33	290	4.94	131	1.17
5/4/2	60	33.72	1549	24.38	340	5.79	386	3.43
5/4/3	0	32.64	1173	18.46	330	5.62	255	2.27
5/4/3	60	33.01	690	10.86	460	7.84	125	1.11
5/4/4	0	32.36	333	5.24	350	5.96	268	2.38
5/4/4	60	32.37	333	5.24	380	6.47	597	5.31
5/4/5	0	32.79	238	3.75	260	4.43	146	1.30
5/4/5	40	32.81	333	5.24	260	4.43	199	1.77
5/4/6	0	32.99						
5/4/6	25	33.00						
5/4/7	0	33.37						
5/4/7	40	33.46						
5/4/8	0	33.74	309	4.86	260	4.43	87	.77

STATION	DEPTH	SAL.	Cu ng/l	Cu nmol/l	Ni ng/l	Ni nmol/l	Cd ng/l	Cd nmol/l
5/4/8	44	33.76	548	8.62	825	14.05	653	5.80
5/4/9	0	33.13	380	5.98	300	5.11	146	1.30
5/4/9	40	33.66	429	6.75	170	2.90	75	.67
5/4/10	0	33.51	178	2.80	140	2.39	37	.33
5/4/10	70	34.10	250	3.93	110	1.87	37	.33
5/4/11	0	33.86	226	3.51	250	4.26	50	.44
5/4/11	40	33.90	190	2.99	240	4.09	47	.42
5/4/12	0	33.79	190	2.99	300	5.11	106	.94
5/4/12	70	34.21	309	4.86	350	5.96	112	1.00
5/4/13	0	33.53	476	7.49	350	5.96	212	1.89
5/4/13	73	34.30	357	5.62	360	6.13	100	.89
5/4/14	0	33.00	500	7.87	360	6.13	16	.14
5/4/14	69	32.96	167	2.63	310	5.28	81	.72
5/4/15	0	33.77	250	3.92	340	5.79	87	.77
5/4/15	105	34.40	571	8.99	320	5.45	47	.42
5/4/16	0	33.84	310	4.88	260	4.43	53	.47
5/4/16	40	34.06	476	7.49	380	6.47	196	1.74
5/4/17	0	33.58	310	4.88	330	5.62	75	.67
5/4/17	45	34.20	214	3.37	290	4.94	100	.89
26.64/18	0	33.82	154	2.42	580	9.88	89	.79
5.4.18	110	34.43	124	1.95	170	2.90	16	.14
5/4/19	0	33.08	252	3.97	530	9.03	118	1.05
5/4/19	35	33.30	183	2.88	310	5.28	25	.22
5/4/20	0	34.29	114	1.79	260	4.43	3	.03
	50	34.37						
	100	34.5	88	1.38	550	9.36	13	.12
	250	34.67	85	1.34	440	7.5	48	.42
	500	34.83	134	2.11	440	7.5	57	.51
	750	34.79						
	1000	34.78	301	4.74	600	10.22	64	.57
	1500	34.9	163	2.56	460	7.84	70	.63
	2000	34.99	507	7.98	440	7.5	73	.65
	3000	34.93	271	4.27	455	7.75	73	.65
	4000	34.92	418	6.58	380	6.47	76	.68
	5000	34.9	869	13.68	500	8.52	64	.57
	6000	34.9	575	9.05	310	5.28	67	.6
5/4/21	0	34.3	65	1.02	210	3.58	1	.01
	30	34.						
	85	34.37	154	2.42	340	5.79	16	.14
	150	34.43	85	1.34	340	5.79	19	.17
	270	34.64	173	2.72	440	7.5	13	.12
	500	34.75	271	4.27	440	7.5	67	.6
	750	34.77						
	1000	34.78	262	4.12	390	6.64	80	.71
	1500	34.88	154	2.42	1060	18.06	76	.68
	2000	34.93	144	2.27	460	7.84	25	.22
	2500	34.93	301	4.78	980	16.7	60	.53
	3000	34.93	458	7.21	390	6.64	61	.54
	4175	34.92	163	2.57	1820	31.	70	.62
5/4/22	0	33.5	114	1.79	140	2.39	1	.01
	45							
	100	34.22	1614	25.4	320	5.45	2	.01
	250	34.6	1291	20.32	260	4.43	73	.65
	500	34.73	144	2.27	300	5.11	59	.52
	1000	34.74	252	3.97	580	9.88	69	.61
	1500	34.86	409	6.47	280	4.77	50	.44
5/4/23	0	33.6	262	4.12	350	5.96	10	.09

STATION	DEPTH	Zn ng/l	Zn nmol/l	Fe µg/l	Fe µmol/l	Pb ng/l	Pb nmol/l	PO_4 µgat/l	SiO_4 µgat/l
2	0	240	3.70	.71	.0127	110	.531	.10	7.52
	45	450	6.90	1.13	.0200	88	.425	.22	6.57
3	0	330	5.00	.51	.0091	88	.425	.10	5.92
	40	380	5.80	.58	.0104	60	.290	1.33	6.19
5	0	1140	17.40	.51	.0091			.20	5.03
	40			.40	.0072	206	.994	1.64	4.56
6	0	230	3.50	.27	.0048	46	.222	.36	1.84
	63	1080	16.50	.33	.0059	79	.381	3.06	1.66
7	0	480	7.30	.15	.0029	152	.734	.09	5.62
	66			.28	.0050	133	.642	.30	2.66
8	0	190	2.90	.41	.0073	115	.555	.04	1.70
	70	990	15.10	.77	.0138	201	.970	.12	1.70
9	0	480	7.30	.29	.0052	152	.734	.18	2.73
	77	990	15.10	1.00	.0179	70	.338	.17	5.57
10	0	640	9.80	.50	.0090	174	.840	.11	1.93
	60			.30	.0054	125	.603	.39	1.93
	110	950	14.50	.63	.0113	70	.338	7.59	11.05
11	0	1990	30.40	1.20	.0215	193	.931	.13	4.60
	24	350	5.30	.51	.0091	51	.246	.39	7.78
12	0	520	8.00	1.68	.0301			.13	4.12
	25	570	8.70	.60	.0107	119	.574	.12	3.10
	100	1250	19.10	4.00	.0716	60	.290	1.00	21.10
	250	490	7.50	1.00	.0179			.96	26.00
	500			3.50	.0627			2.06	55.06
	750	990	15.10	.95	.0170	51	.246	2.20	76.54
	1500	890	13.60	.93	.0167	19	.091	2.90	102.60
	2000	1720	26.30	.72	.0129	201	.970	2.93	103.20
	2500	570	8.70	.58	.0104	65	.313	2.47	
	3000	1350	20.70	.41	.0073	42	.203	2.61	110.30
	3100	1270	19.40	.62	.0111	78	.376	2.41	113.50
14	0	1410	21.60	1.50	.0269			8.80	4.25
	50	580	8.90	.41	.0073	60	.290	.16	4.35
	150							1.01	16.82
	200	940	14.40	.70	.0125	37	.179	1.46	31.91
	300							2.00	43.52
	400	1200	18.40	.74	.0132	152	.734	2.10	43.52
	500							2.29	53.09
	600	500	7.60	.35	.0063			2.39	73.20
	750	980	15.00	1.10	.0197	60	.290	2.73	85.28
	1000	1080	16.50	1.10	.0197	70	.338	3.14	79.28
	1500	1040	15.90	1.79	.0321	65	.314	2.84	73.86
	2000							2.85	90.70
	2500	1340	20.50	.60	.0107	119	.574	2.88	94.76
	3000							2.07	115.84
14	3500	1080	16.50	.64	.0115	101	.487	2.85	106.18
	4000							2.67	114.30
	4500	1300	19.90	.60	.0107	42	.202	2.00	119.
52	5000	1660	25.40	.72	.0129			2.57	122.42
18	0	1420	21.70	.68	.0122	74	.357		5.20
	50	730	11.20	1.95	.0349	74	.357	.82	11.00
	100							2.14	40.40
	250	1020	15.60	.64	.0114	19	.091	1.33	29.30
	400	1320	20.20	2.60	.0466	32	.154	2.51	75.70
	750	930	14.20	1.00	.0179	42	.203	2.60	72.50
	1000	2000	45.90	4.00	.0716			2.77	80.50
	1200	1010	15.50	2.24	.0401	14	.068	2.78	92.90

		Zn		Fe		Pb		PO_4	SiO_4
STATION	DEPTH	ng/l	nmol/l	µg/l	µmol/l	ng/l	nmol/l	µgat/l	µgat/l
19	0	690	10.60	.79	.0141	78	.377		3.20
21	0	160	2.40	.73	.0131	102	.492	.22	4.86
	90	440	6.70	.22	.0039	51	.246	.22	8.24
22	0	190	2.90	.19	.0034	59	.285	.21	4.12
	53	290	4.40	1.08	.0193	59	.285	.51	16.32
23	0	320	4.90	.22	.0039	51	.246	.19	15.14
	40	370	5.70	.15	.0027	92	.444	.68	17.18
24	0	220	3.40	.24	.0043	51	.246	.21	4.83
	60	120	1.80	.14	.0025	42	.203	.18	4.03
25	0	1180	18.10	.41	.0073	221	1.067	.33	4.29
	45	660	10.10	.38	.0068	240	1.158	.77	3.29
26	0	360	5.50	.30	.0054	97	.468	.26	7.52
	17			1.04	.0186			4.23	5.72
5/2/1	0	700	10.70	16.10	.2880			1.32	106.
5/2/2	0	960	14.70	3.70	.0662			.75	318.
5/2/3	0	970	14.80	4.10	.0734			1.98	451.
5/2/4	0	1780	27.20	3.70	.0662			2.12	504.
5/2/5	0	600	9.10	4.20	.0752			2.36	527.
5/2/6	0	970	14.80	6.30	.1128			2.41	590.
5/2/7	0	2100	32.10	8.60	.1540			*	646.
5/2/8	0	1910	29.20	1.50	.0269			8.59	634.
5/2/9	0	1730	26.50	4.10	.0734			3.11	661.
5/2/10	0	1560	23.90	3.40	.0609			4.30	710.
5/2/11	0	960	14.70	3.50	.0627			3.54	722.
5/2/12	0	840	12.80	2.90	.0519			3.54	680.
5/2/13	0								
5/2/14	0	710	10.90	2.40	.0430			3.11	659.
5/2/15	0								
5/2/16	0	320	4.90	2.70	.0358			3.09	667.
5/2/17	0								
5/2/18	0	250	3.80	3.10	.0555			3.21	682.
5/2/19	0								
5/2/20	0	510	7.80	3.80	.0680			3.21	672.
5/2/21	0	1320	20.20	3.60	.0645			9.99	676.
5/2/22	0	840	12.80	3.80	.0680			3.30	668.
5/2/23	0	1400	21.40	4.10	.0734			2.22	616.
5/2/24	0	1160	17.70	3.40	.0609			2.17	616.
5/2/25	0	1500	22.90	3.30	.0590			.71	657.
5/2/26	0	700	10.70	4.0	.0716	56	.270		698.
5/2/27	0	530	8.10	3.30	.0591			2.27	721.
5/2/28	0	460	7.00	5.50	.0985			2.45	710.
5/2/29	0	1460	22.30	3.30	.0591			2.78	786.
5/2/30	0	1260	19.30	3.80	.0680			4.25	746.
5/2/31	0	700	10.70	3.00	.0537	560	2.704	3.07	788.
5/2/32	0	900	13.80	8.20	.1468	380	1.834	2.97	769.
5/2/33	0	750	11.50	3.00	.0537	160	.772	.99	853.
5/2/34	0	1160	17.70	3.70	.0662	110	.531		841.
5/2/35	0	960	14.70	4.20	.0752	350	1.689	3.07	841.
5/2/37	0	700	10.70	8.20	.1468	890	4.296	5.57	860.
5/2/39	0	1140	17.40	5.00	.0895	490	2.365	4.48	839.
5/2/40	0	600	9.20	5.50	.0985	500	2.413	3.96	835.
5/2/41	0	1530	23.40	8.60	.1540	820	3.958	4.25	795.
5/2/42	0	6500	99.40	3.50	.0627	2000	9.653	.38	20.10
5/2/43	0	2300	35.20	7.80	.1397	2000	9.653	.27	17.90
5/2/44	0	900	13.80	3.60	.0645	610	2.944	.48	14.50
5/2/45	0	900	13.80	4.00	.0716	430	2.075	.75	9.00

STATION	DEPTH	Zn ng/l	Zn nmol/l	Fe µg/l	Fe µmol/l	Pb ng/l	Pb nmol/l	PO_4 µgat/l	SiO_4 µgat/l
5/2/46	0	1200	18.40	2.30	.0412	960	4.633	.65	8.80
5/2/47	0	1000	15.30	2.40	.0430	310	1.496	.27	10.90
5/2/48	0	1100	16.80	2.80	.0501	2000	9.653		8.80
5/2/49	0	350	5.40	3.50	.0627	610	2.944	.38	21.
5/2/50	0	370	5.70	4.60	.0824	360	1.738	.27	15.90
5/2/51	0	400	6.10	2.10	.0376	120	.578	.05	10.50
5/2/52	0	330	5.00	2.60	.0466	170	.821		8.00
5/2/53	0	610	9.30	3.30	.0591	230	1.110	.32	8.
5/2/54	0	860	13.20	1.60	.0286	1240	5.985		14.40
5/2/55	0	860	13.20	3.00	.0537	1360	6.564		34.00
5/2/56	0	440	6.70	1.70	.0304	430	2.075	.27	21.80
5/2/57	0	370	5.70	.90	.0161	380	1.834	.10	17.60
5/2/58	0	870	13.30	3.30	.0591	350	1.689	.43	15.50
5/2/59	0	530	8.10	2.00	.0358	310	1.496	.05	13.30
5/2/60	0	1970	30.10	1.60	.0286	660	3.185	.27	11.30
5/2/61	0	1310	20.00	1.50	.0269	1000	4.826		6.90
5/2/62	0	790	12.10	5.40	.0967	2000	90.653	.16	45.90
5/2/64	0	680	10.40	5.10	.0913	1950	9.412		229.
5/2/66	0	730	11.70	4.70	.0842	1550	7.481	.10	42.
5/2/68	0	770	11.80	1.90	.0340	630	3.041	.22	63.00
5/2/70	0	1410	21.60	1.00	.0179	2000	9.653	.91	341.
5/2/71	0	3200	49.00	2.50	.0448	2000	9.653		18.80
5/2/73	0	950	14.50	6.20	.1110	760	3.668	.38	82.10
5/2/83	0	2010	30.70	20.	.3581	780	3.765	.59	27.50
5/2/84	0	1780	27.20	20.	.3581	560	2.703	.86	27.20
5/2/85	0	2010	30.70	20.	.3581	730	3.523	1.51	23.40
5/2/86	0	5300	81.10	20.	.3581	720	3.475	1.29	22.90
5/2/87	0	1810	27.70	20.	.3581	500	2.413	1.93	13.60
5/2/88	0			20.	.3581	2000	9.653	1.39	17.60
5/2/89	0			20.	.3581	1950	9.412	1.39	20.50
5/2/90	0			20.	.3581	1550	7.481	.89	19.30
5/2/91	0			20.	.3581	910	4.392	1.39	13.60
5/2/92	0			7.80	.1397	600	2.896	.89	8.80
5/2/93	0			.60	.0107	1780	8.591	1.39	7.90
5/2/94	0			2.40	.0430	630	3.041	1.39	7.70
5/2/95	0			7.8	.1397	2000	9.653	1.78	7.70
5/2/96	0			9.20	.1647	600	2.896	1.88	8.50
5/2/97	0			3.00	.0537	230	1.110	2.43	10.60
5/2/98	0			7.80	.1397	200	.965	1.93	16.40
5/2/99	0			4.80	.0859	2000	9.653	2.92	76.50
5/2/99B				8.60	.1540	1300	6.274	2.48	38.40
5/2/100	0			.60	.0107	2000	9.653	3.37	193.20
5/2/100B				2.80	.0501	930	4.489	3.27	57.
5/2/101	0			3.00	.0537	960	4.633	3.37	254.
5/2/101B				20.00	.3581	1000	4.826	3.91	55.00
5/2/102	0			3.50	.0627	170	.820	3.37	284.
5/2/102B				7.60	.1361	150	.724		
5/2/103	0			.60	.0107	230	1.110	3.37	333.00
5/2/103B				2.20	.0394	220	1.062		
5/2/104	0			3.90	.0698	185	.893	3.42	343.00
5/2/104B				6.60	.1182	190	.917	1.20	373.00
5/2/105	0			3.50	.0627	870	4.199	2.97	341.00
5/2/105B				3.30	.0591	140	.676	3.37	363.
5/2/106	0			1.80	.0322	230	1.110	3.37	374.00
5/2/106B				1.80	.0322	200	.965		
5/2/107	0	2400	36.70	20.00	.3580	1440	6.950	2.36	367.00
5/2/108	0	1550	23.70	1.00	.0179	470	2.268	1.62	393.00
5/2/109	0	1810	27.70	1.70	.0304	280	1.351	1.57	397.00

STATION	DEPTH	Zn ng/l	Zn nmol/l	Fe µg/l	Fe µmol/l	Pb ng/l	Pb nmol/l	PO_4 µgat/l	SiO_4 µgat/l
5/2/110	0	1550	23.70	3.50	.0626	230	1.110	1.81	393.00
5/2/111	0	1500	22.90	1.10	.0197	190	.917	1.81	367.00
5/2/112	0	1600	24.40	2.60	.0466	140	.676	2.45	412.
5/2/113	0	1810	27.70	2.60	.0466	920	4.440	1.99	415.
5/2/114	0	1380	21.10	2.60	.0466	190	.917	1.94	422.
5/2/115	0	1600	24.50	.50	.0090	105	.507	1.90	440.
5/2/116	0	1310	20.00	.50	.0090	150	.724	1.85	422.
5/2/117	0	1620	24.80	3.00	.0537	110	.531	1.85	411.
5/2/118	0	1500	22.90	8.60	.1540	520	2.510	1.62	410.
5/2/119	0	4520	69.10	4.40	.0788	2000	9.653	1.67	404.
5/2/120	0	1810	27.70	4.10	.0734	1430	6.902	1.67	411.
5/2/121	0	1020	15.60	6.30	.1128	1110	5.357	1.62	364.
5/2/122	0	1600	24.50	3.20	.0573	970	4.682	2.18	903.
5/2/123	0	1600	24.40	3.00	.0537	250	1.207	.79	870.
5/2/124A	0	3400	51.90	29.50	.0582	866	4.181	1.11	417.
5/2/124B	0							1.16	415.
5/2/124C	0							1.16	403.
5/3/2001	0	3960	60.60	12.00	.2149	530	2.560		468.
5/3/2002	0	2600	39.80	15.40	.2757	658	3.180		446.
5/3/2003	0	650	9.90	10.30	.1844	383	1.850		419.
5/3/2004	0	1430	21.90	6.40	.1146	1355	6.540		400.
5/3/2005	0	4500	68.80	7.80	.1397	493	2.380		382.
5/3/2006	0	2700	41.30	31.80	.5694	402	1.940		300.
5/3/2007	0	3400	52.00	41.00	.7341	1868	9.000		337.
5/3/2008	0	870	13.30	11.50	.2059	1832	8.800		291.
5/3/2009	0	800	12.20	14.50	.2596	622	3.000		173.
5/3/2010	0	1110	17.00	5.00	.0895	823	4.000		655.
5/3/2011	0	970	14.80	9.20	.1647	768	3.710		455.00
5/3/2012	0	590	9.00	4.80	.0859	1043	5.030		455.00
5/3/2013	0	1900	29.10	2.00	.0358	1447	6.980		455.00
5/3/2014	0	1150	17.60	7.60	.1361	1355	6.540		446.00
5/3/2015	0	680	10.40	17.70	.3169	933	4.500		419.00
5/3/2016	0	1750	26.80	19.00	.3402	567	2.740		391.00
5/3/2017	0	530	8.10	8.50	.1522	328	1.580		355.00
5/3/2018	0	530	8.10	7.30	.1307	328	1.580		337.00
5/3/2019	0	3140	48.00	20.70	.3706	1447	6.980		309.00
5/3/2020	0	1040	15.90	8.70	.1558	1575	7.600		364.00
5/3/2021	0	1850	28.30	7.10	.1271	805	3.890		382.00
5/3/2022	0	2000	30.60	10.80	.1934	933	4.500		400.00
5/3/2023	0	450	6.90	7.30	.1387	622	3.000		428.00
5/3/2024	0	5500	84.10	11.00	.1970				17.00
5/3/2025	0	5500	84.10	28.00	.5013	2913	14.060		18.00
5/3/2027	0	2000	30.60	12.20	.2184	1227	5.920		18.00
5/3/2028	0	950	14.50	49.90	.8935	1139	5.500		18.00
5/3/2029	0	1300	19.90	15.00	.2686	1427	6.890		20.00
5/3/2030	0	1200	18.30	22.6	.4047	1283	6.180		20.00
5/3/2031	0	1250	19.10	29.00	.5192	2175	10.480		20.00
5/3/2032	0	1520	23.20	39.00	.6983	1341	6.460		13.00
5/3/2033	0	2600	39.80	45.00	.8057	1039	5.010		13.00
5/3/2034	0	5500	84.10	59.00	1.0564				744.00
5/3/2035	0	3400	52.00	32.80	.5873	2247	10.840		705.00
5/3/2036	0	1490	22.80	28.60	.5121	1427	6.890		705.00
5/3/2037	0	3700	56.60	35.10	.6285	1628	7.860		694.
5/3/2038	0	1330	20.30	33.50	.5998	622	3.000		694.
5/3/2039	0	2400	36.70	27.00	.4834	564	2.720		725.00
5/3/2040	0	1850	28.20	46.00	.8236	1571	7.580		728.00
5/3/2041	0	4700	71.90	46.00	.8236	1427	6.890		757.00

STATION	DEPTH	Zn ng/l	Zn nmol/l	Fe µg/l	Fe µmol/l	Pb ng/l	Pb nmol/l	PO_4 µgat/l	SiO_4 µgat/l
5/3/2042	0	2660	40.70	11.00	.1970	1139	5.500		752.00
5/3/2043	0	3200	48.90	16.00	.2865	924	4.460		732.00
5/3/2044	0	1150	17.60	32.80	.5873	488	2.360		726.00
5/3/2045	0	1500	22.90	39.00	.6982	453	4.830		735.00
5/3/2047	0	4900	74.90	16.00	.2865				642.00
5/3/2048	0	3260	49.80	29.40	.5264	1511	7.290		650.00
5/3/2049	0	3700	56.60	36.00	.6446	744	3.590		342.
5/3/2050	0	1340	20.50	34.00	.6088	384	1.850		29.00
5/3/2051	0	1430	21.90	17.70	.3169	453	2.190		594.00
5/3/2052	0	2760	42.20	33.00	.5909	1558	7.520		537.00
5/3/2053	0	1450	22.20	23.50	.4208	1279	6.170		456.00
5/3/2054	0	1620	24.80	37.40	.6697	1465	7.060		378.00
5/3/2055	0	2000	30.60	46.60	.8343	1012	4.880		424.00
5/3/2056	0	1480	22.60	25.00	.4476	686	3.310		424.00
5/3/056A	0			16.40	.2936	535	2.580		
5/3/2057	0	1080	16.50	10.00	.1791	733	3.540		27.
5/3/2061	0	3120	47.70	21.20	.3796	2649	12.780		34.00
5/3/2062	0	1290	19.70	11.30	.2023	2491	12.020		38.00
5/3/2063	0	1600	24.50	12.00	.2149	852	4.110		27.00
5/3/2064	0	1600	24.50	10.80	.1934	1571	7.580		24.00
5/3/2065	0	930	14.20	20.00	.3581	1039	5.010		9.40
5/3/2066	0	830	12.70	39.70	.7108	1384	6.680		19.00
5/3/2067	0	3600	55.00	21.90	.3921	2937	14.170		8.10
5/3/2068	0	1050	16.10	40.00	.7162	1024	4.940		15.00
5/3/2069	0	1290	19.70	*	3.0081	794	3.830		10.00
5/3/2070	0	1240	19.00	36.00	.6446	1240	5.980		12.00
5/3/2071	0	2000	30.60	30.50	.5461	2937	14.170		17.00
5/3/2072	0	1080	16.50	3.90	.0698	1182	5.700		14.00
5/3/2073	0	920	14.10	5.30	.0949	808	3.900		14.00
5/3/2074	0	1300	19.90	20.00	.3581	2433	11.740		297.00
5/3/2075	0	1550	23.70	12.40	.2220	2764	13.634		44.00
5/3/2076	0	2400	36.70	4.30	.0770	1657	8.000		45.00
5/3/072A	0								
5/3/073A	0								
5/3/074A	0								
5/3/075A	0								
5/3/076A	0								
5/3/2077	0	1700	26.00	55.00	.9848	593	2.860		20.00
5/3/071C	0			5.70	.1021				
5/3/077A	0								
5/3/2078	0	1450	22.20	13.40	.2399	2621	12.600		14.00
5/3/2079	0	550	8.40	9.20	.1647	1139	5.500		38.00
5/3/2080	0	1750	26.80	15.	.2686	1858	9.000		39.00
5/4/1	0	4000	61.20	50.20	.8989	854	4.122		8.80
5/4/1	43	510	7.80	13.10	.2346	388	1.873		6.20
5/4/2	0	850	13.00	33.20	.5944	595	2.872		5.60
5/4/2	60	3000	45.90	9.70	.1737	771	3.721		6.20
5/4/3	0	50	.80	62.00	1.1101	616	2.973		4.40
5/4/3	60	850	13.00	29.00	.5192	306	1.477		5.50
5/4/4	0	450	6.90	46.00	.8236	512	2.471		4.50
5/4/4	60	850	13.00	13.00	.2328	254	1.226		6.10
5/4/5	0	450	6.90	12.00	.2149	430	2.075		4.30
5/4/5	40	650	9.90	53.00	.9490	202	.975		5.10
5/4/6	0								5.80
5/4/6	25								6.60
5/4/7	0								6.50
5/4/7	40								9.50
5/4/8	0	450	6.90	5.30	.0949	275	1.327		7.40

STATION	DEPTH	Zn ng/l	Zn nmol/l	Fe µg/l	Fe µmol/l	Pb ng/l	Pb nmol/l	PO_4 µgat/l	SiO_4 µgat/l
5/4/8	44	3700	56.60	4.30	.0770	533	2.572		7.50
5/4/9	0	1250	19.10	29.00	.5192	430	2.075		7.00
5/4/9	40	1330	20.30	2.70	.0483	150	.724		6.20
5/4/10	0	120	1.80	.78	.0140	275	1.327		7.80
5/4/10	70	200	3.10	.74	.0132	254	1.226		15.80
5/4/11	0	180	2.80	.83	.0149	378	1.824		6.00
5/4/11	40	130	2.00	.66	.0118	161	.777		8.00
5/4/12	0	300	4.60	.87	.0156	233	1.125		6.50
5/4/12	70	400	6.10	3.40	.0609	233	1.125		15.80
5/4/13	0	1950	29.80	2.00	.0358	647	3.123		8.60
5/4/13	73	900	13.80	.68	.0122	223	1.076		6.80
5/4/14	0	1850	28.30	16.00	.2865	2000	9.653		3.90
5/4/14	69	680	10.40	11.00	.1970	812	3.919		6.60
5/4/15	0	200	3.10	18.00	.3223	213	1.028		5.50
5/4/15	105	250	3.80	6.20	.1110	440	2.124		16.00
5/4/16	0	350	5.40	3.20	.0573	233	1.125		8.30
5/4/16	40	780	11.90	.74	.0132	244	1.178		9.30
5/4/17	0	570	8.70	1.60	.0286	523	2.524		8.00
5/4/17	45	310	4.70	2.70	.0483	213	1.028		26.60
26.64/18	0	330	5.00	7.30	.1307	163	.790		4.90
5.4.18	110	280	4.30	.64	.0115	108	.520		12.70
5/4/19	0	920	14.10	.81	.0145	127	.610		5.50
5/4/19	35	400	6.10	2.70	.0483	72	.350		5.00
5/4/20	0	820	12.50	1.05	.0188	1538	7.420		1.80
	50								4.3
	100	330	5.	.62	.0111	805	3.89		11.2
	250	290	4.4	.88	.0158	200	.97		38.6
	500	440	6.7	15.4	.2757	72	.35		48.2
	750								69.8
	1000	1140	17.4	2.	.0358	90	.43		90.8
	1500	1200	18.3	10.1	.1808	53	.26		100.
	2000	850	13.	2.5	.0448	200	.97		107.8
	3000	1150	17.6	1.6	.0286	127	.61		117.4
	4000	1000	15.3	2.7	.0483	72	.35		106.6
	5000	820	12.5	7.3	.1307	127	.61		71.2
	6000	680	10.4	3.2	.0573	145	.7		122.
5/4/21	0	90	1.4	.67	.012	130	.627		2.3
	30								2.5
	85	140	2.1	.31	.0056	63	.304		4.
	150	160	2.4	.31	.0056	32	.154		22.7
	270			.19	.0034	368	1.776		44.9
	500	430	6.6	.26	.0047	37	.179		60.7
	750								80.5
	1000	690	10.6	.64	.0115	32	.154		109.4
	1500	690	10.6	.6	.0107	326	1.573		117.6
	2000	10	.15	.26	.0047	83	.401		123.6
	2500	8	.12	.69	.0124				120.9
	3000	900	13.8	.48	.0086	104	.502		130.8
	4175	310	4.7	.62	.0111	37	.179		145.4
5/4/22	0	40	.6	.38	.0068	27	.130		5.7
	45								4.3
	100	180	2.8	.88	.0158	336	1.622		6.5
	250	250	3.8	.55	.0098	89	.430		43.1
	500	730	11.2	.48	.0086	218	1.05		49.4
	1000	1460	22.3	.4	.0072	90	.43		92.5
	1500	850	13.	.64	.0115	108	.52		107.9
5/4/23	0	540	8.3	.57	.0102	200	.97		3.4

Table X

Elemental content of suspended particulate matter in all regions.
Minor elements ug.g^{-1} and major elements in %.
A = Total content
B = % Leachable of total content

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
07-07	2	0	5.33.69	104.12.54	1.7	225			0.93	
		45			1.1	396			1.36	
08-07	3	0	5.30.14	108.29.34	1.0	456			1.37	
		40			1.2	627			1.48	
10-07	5	0	5.29.00	109.36.04	1.4	744			0.57	
		40			1.7	435			0.49	
11-07	6	0	5.31.45	111.25.08	0.9	768			0.80	
		63			1.2	515			0.65	
12-07	7	0	5.30.00	112.52.00	2.0	190			0.54	
		66			1.6	144			0.54	
14-07	8	0	6.10.02	113.57.00	1.4	318			0.56	
		70			1.9	417			0.71	
15-07	9	0	7.02.46	115.14.83	1.9	98			0.15	
		77			1.5	139			1.00	
	10	0	7.22.16	114.51.46	1.0	408			0.26	
		60			5.5	277			0.18	
		110			1.4	351			1.91	
19-07	11	0	8.20.00	114.25.00	2.0	249			0.26	
		24			1.9	657			1.05	
20-07	12	0	9.47.05	114.14.14						
		25								
		100								
		250								
		500								
		750								
		1500								
		2000								
		2500								
		3000								
		3100								
22-07	14	0			1.3	131			0.08	
		50								
		150								
		200								
		300								
		400								
		500								
		600								
		750								
		1000								
		1500								
		2000								
		2500								
		3000								
22-07	14	3500								
		4000								
		4500								
		5000								

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
23-07	18	0			1.5	152			0.20	
		50								
		100								
		250								
		400								
		750								
		1000								
		1200								
23-07	19	0			1.7	508			0.10	
16-07	21	0	7.26.66	144.20.23	1.2	372			0.51	
		90			1.0	877			1.30	
18-07	22	0	7.28.01	133.38.05	1.3	200			0.20	
		53			1.5	359			0.70	
17-07	23	0	7.25.17	113.12.04	1.6	581			0.26	
		40			2.3	126			0.20	
16-07	24	0	6.59.06	114.16.18	1.1	183			0.40	
		60			1.1	409			0.98	
13-07	25	0	6.41.03	112.47.07	1.8	272			0.84	
		45			1.9	573			1.08	
13-07	26	0	6.51.08	112.44.00	3.0	302	47	1061	4.29	16.5
		17			4.4	287	52	1020	3.50	20.0
28-07	5/2/1	0	PORONG		53.9			1586	8.44	9.8
	5/2/2	0			31.8	119	32	1572	3.85	19.4
	5/2/3	0			17.3	130	38	2025	4.19	17.1
	5/2/4	0			23.7	105	34	2764	4.65	16.5
	5/2/5	0			20.4	139	40	2941	4.38	17.1
	5/2/6	0			23.7	139	38	2574	4.41	14.7
	5/2/7	0			19.4	203	43	2680	4.23	24.3
	5/2/8	0			21.6	204	46	3009	4.48	16.2
	5/2/9	0			17.9	156	32	2486	4.23	14.8
	5/2/10	0	PORONG	A.S.	27.8	186	40	1583	4.66	14.3
	5/2/11	0			17.8	179	47	1461	3.84	17.9
	5/2/12	0			25.6	174	43	1680	4.55	14.9
	5/2/13	0								
	5/2/14	0			33.4	152	38	2216	4.41	16.5
	5/2/15	0								
	5/2/16	0			23.2	191	57	2241	5.18	12.5
	5/2/17	0								
	5/2/18	0			24.4	167	34	1942	4.96	14.1
	5/2/19	0								
	5/2/20	0			24.4	177	39	2090	4.90	16.3
	5/2/21	0			22.4	157	43	1964	4.62	16.0
	5/2/22	0			25.6	183	43	2539	4.73	13.3
	5/2/23	0			24.8	143	42	2903	4.73	14.8
	5/2/24	0			28	207	41	2036	4.06	18.2
	5/2/25	0			24.6	140	35	2317	4.08	19.3
	5/2/26	0			17.7	159	26	2740	4.44	16.8
	5/2/27	0			16	173	27	2594	3.93	16.5
	5/2/28	0			18.1	161	31	2652	4.37	11.4
	5/2/29	0			16.5	177	29	2576	3.36	21.4
	5/2/30	0			12.7	230	29	2402	4.02	14.6
	5/2/31	0			23	131	50	2261	4.15	15.1
	5/2/32	0			11.1	197	25	1757	4.33	15.7
	5/2/33	0			41.0	175	31	1012	4.32	16.
	5/2/34	0			11.6	204	36	1509	4.66	14.0
	5/2/35	0			13.6	160	32	1618	4.73	14.6

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
	5/2/37	0	PORONG	F.W.	19.7	130	41	1777	5.32	14.1
	5/2/39	0			21.3	121	41	1995	5.15	13.4
	5/2/40	0			20.2	133	35	1733	5.77	14.2
	5/2/41	0			15.8	111	34	1519	5.51	13.6
03-08	5/2/42	0	STRAIT	MADURA	15.5	73	33	710	4.61	16.1
	5/2/43	0			6.8	157	51	662	3.86	15.3
	5/2/44	0			5.7	117	34	789	4.06	15.8
	5/2/45	0			5.7					
	5/2/46	0			17.3	30			.16	
	5/2/47	0			3.6	106			.14	
	5/2/48	0			3.7	65			.22	
04-08	5/2/49	0			30.6	42	18	425	2.41	16.6
	5/2/50	0			6.6	139	33	682	4.02	15.2
	5/2/51	0			4.2	117			2.43	
	5/2/52	0			4.5	76			.47	
	5/2/53	0			4.2	114			.43	
	5/2/54	0			3.6	89			.22	
	5/2/55	0			1.7	300			1.24	
	5/2/56	0			8.7	71	44	677	3.91	17.4
05-08	5/2/57	0			4.6	116	34	1121	3.24	15.7
	5/2/58	0			2.6	24			1.23	
	5/2/59	0			4.2	148			.46	
	5/2/60	0			3.7	210			1.61	
	5/2/61	0			3.7	176			.76	
06-08	5/2/62	0	WONOKRO	MO RIVER	18.0	84	26	556	4.21	15.0
	5/2/64	0			30.4	70	42	826	4.45	11.2
	5/2/66	0			17.9	90	40	1313	4.29	24.
	5/2/68	0			19.3	74	38	674	4.58	12.9
	5/2/70	0			52.0	85	54	1221	4.85	19.6
	5/2/71	0	PORONG	RIVER	6.5	82	51	985	2.68	13.1
	5/2/73	0			22.2	30	100	1377	5.19	17.9
09-08	5/2/83	0	SURABAJA	TO SOLO	46.4	41	27	334	3.38	16.6
	5/2/84	0			54.5	48	33	692	3.71	12.1
	5/2/85	0			53.3	47	35	631	3.34	13.2
	5/2/86	0			15.2	63	40	689	3.94	15.7
	5/2/87	0			8.6	90	40	5748	4.25	18.6
	5/2/88	0			9.7	97	42	934	4.77	14.7
	5/2/89	0			9.8	106	39	787	4.20	18.3
	5/2/90	0			23.0	52	42	968	4.23	14.
	5/2/91	0			35.8	91	29	647	3.75	15.0
	5/2/92	0			22.6	65	23	582	2.79	11.5
11-08	5/2/93	0	SOLO	L.S.	4.5	122			1.14	
	5/2/94	0			22.7	64	28	680	2.67	16.9
	5/2/95	0			21.9	50	54	705	2.64	17.4
	5/2/96	0			37.2	60	22	807	3.08	12.7
	5/2/97	0			44.2	52	30	916	3.38	18.1
	5/2/98	0			69.5	25	55	681	3.45	15.4
	5/2/99	0			25.9	31	42	684	1.79	12.9
	5/2/99B				39.8	29	52	845	1.08	25.9
	5/2/100	0			17.1	95	19	824	2.27	16.7
	5/2/100B				38.8	57	39	867	3.44	18.6
	5/2/101	0			12.6	52	47	1942	2.12	29.7
	5/2/101B				32.4	53	40	758	3.47	11.8
	5/2/102	0			11.3	56	54	2540	2.47	19.0
	5/2/102B				44.4	48	41	912	3.40	11.8
	5/2/103	0			10.8	82	45	3109	2.45	26.5
	5/2/103B				24.8	32	63	1410	2.15	20.9
	5/2/104	0			12.8	86	54	3156	2.88	23.6
	5/2/104B				20.1	67	37	2262	3.18	25.2

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
	5/2/105	0			16.9	67	35	2285	1.95	27.2
	5/2/105B				19.0	66	47	2297	3.27	23.2
	5/2/106	0			6.2	149	54	4191	3.52	10.8
	5/2/106B				12.9	92	50	3275	3.35	14.7
13-08	5/2/107	0	SOLO	A.S.	12.1	70	48	2727	2.62	27.5
	5/2/108	0			10.4	84	43	2788	2.86	24.5
	5/2/109	0			12.0	150	37	2986	2.46	35.8
	5/2/110	0			10.2	82	48	2843	2.87	27.2
	5/2/111	0			7.0	163	57	2786	3.43	28.4
	5/2/112	0			30.2	94	41	1409	4.97	
	5/2/113	0			23.3	87	66	1821	3.62	14.1
	5/2/114	0			5.5	370	65	3485	3.61	15.5
	5/2/115	0			21.	121	53	952	3.19	21.6
	5/2/116	0			10.5	269	41	2937	4.41	11.8
	5/2/117	0			9.3	150	40	2768	3.78	12.2
	5/2/118	0			23.0	125	32	1775	3.89	13.4
	5/2/119	0			14.3	112	50	1993	3.00	13.7
	5/2/120	0			9.7	113	55	2629	3.50	17.1
	5/2/121	0			8.4	115	62	1726	2.17	24.
15-08	5/2/122	0	K.MAS.	F.W.	22.8	182	48	1170	4.94	11.1
	5/2/123	0	WONOKRO	MO F.W.	16.3	296	68	3730	3.51	13.7
	5/2/124A	0	SOLO	F.W.	13.8	74	61	2831	2.01	24.9
	5/2/124B	0			12.2	80	52	2329	1.79	14.0
	5/2/124C	0			8.2	131	58	3776	3.11	14.8
17-11	5/3/2001	0	SOLO	L.S.	45.6	65	34	910	4.22	6.4
	5/3/2002	0			35.2	153	59	806	4.73	10.8
	5/3/2003	0			27.3	128	55	488	4.41	15.
	5/3/2004	0			15.3	196	47	486	5.11	13.9
	5/3/2005	0			21.7	152	56	885	4.16	13.9
	5/3/2006	0			24.8	106	76	1040	4.71	13.3
	5/3/2007	0			16.5	120	46	1010	4.40	15.
	5/3/2008	0			29.2	119	50	1057	4.35	11.3
	5/3/2009	0			19.5	146	56	598	3.12	15.1
19-11	5/3/2010	0	SOLO	A.S.	19.3	132	56	690	4.09	14.7
	5/3/2011	0			23.3	127	45	857	4.19	15.8
	5/3/2012	0			21.0	82	53	913	4.09	9.8
	5/3/2013	0			28.0	75	43	684	4.64	8.8
	5/3/2014	0			22.8	140	47	839	4.96	9.5
	5/3/2015	0			7.8					
	5/3/2016	0			10.5					
20-11	5/3/2017	0			10.2	26		900	4.32	
	5/3/2018	0			11.3	145	51	1029	4.64	12.7
	5/3/2019	0			8.8	181	83	1321	5.38	15.2
	5/3/2020	0			15.2	169	55	1099	5.34	10.5
	5/3/2021	0			23.8	107	55	1014	4.61	11.2
	5/3/2022	0			18.5					
21-11	5/3/2023	0	SOLO	F.W.	49.5	93	40	1465	4.51	9.3
22-11	5/3/2024	0	SURABAJA	TO SOLO	37.2					
	5/3/2025	0			17.2	58	48	901	4.18	14.4
	5/3/2027	0			17.8	63	39	815	4.79	13.1
	5/3/2028	0			15.5	67	53	839	4.73	16.1
	5/3/2029	0			10.7	68	51	794	5.13	15.2
	5/3/2030	0			59.6	49	42	880	4.62	12.3
	5/3/2031	0			42.7	64	40	957	4.84	13.2
	5/3/2032	0			12.7	78	51	1250	4.71	12.1
	5/3/2033	0			30.7	57	51	1005	4.50	15.6
26-11	5/3/2034	0	PORONG	A.S.	333.					
	5/3/2035	0			377.					

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
	5/3/2036	0			440.	77	35	1364	5.95	6.4
	5/3/2037	0			782.	71	29	1202	5.08	5.5
	5/3/2038	0			875.3	68	26	1447	5.01	5.8
	5/3/2039	0			659.	79	33	1500	5.61	5.9
	5/3/2040	0			291.5					
	5/3/2041	0			438.5					
	5/3/2042	0			745.	78	33	1599	5.87	10.7
	5/3/2043	0			855.	39	60	1700	2.11	18.
	5/3/2044	0			607.5	89	38	1498	6.11	11.8
	5/3/2045	0			588.5					
29-11	5/3/2047	0	K.SURAB	AJA F.W.	38.5	333	45	3160	18.43	11.9
	5/3/2048	0	WONOKRO	MO F.W	155.2	66	39	430	3.61	7.8
	5/3/2049	0	SOLO	F.W.	916.5	59	26	1140	3.52	3.7
01-12	5/3/2050	0	STRAIT	MADURA	7.6	72			1.06	
	5/3/2051	0			35.9	90	42	487	5.43	7.7
	5/3/2052	0			61.5	157	14	439	14.84	2.5
	5/3/2053	0			27.2	93	49	643	5.12	21.
	5/3/2054	0			33.1	89	41	862	5.56	10.8
	5/3/2055	0			47.	100	47	1170	4.60	10.9
	5/3/2056	0			10.8	118	63	3565	3.66	20.2
	5/3/056A	0			8.8	153	71	625	2.22	15.3
	5/3/2057	0			5.8	56			.65	
	5/3/2061	0			7.8	79			1.08	
	5/3/2062	0			5.5	53			.86	
	5/3/2063	0			3.9	38			1.39	
	5/3/2064	0			3.8	132			2.04	
02-12	5/3/2065	0			2.8	129			.38	
	5/3/2066	0			4.7	151			.40	
	5/3/2067	0			4.3	51			.98	
	5/3/2068	0			7.8	137	79	577	2.76	25.
	5/3/2069	0			6.8	137	81	588	3.13	20.
	5/3/2070	0			10.2	119	70	539	2.76	21.7
	5/3/2071	0			11.5	115	68	478	3.30	18.2
03-12	5/3/2072	0			2.4	33			.27	
	5/3/2073	0			3.2	134			.55	
	5/3/2074	0			4.9	153	80	1061	2.56	20.7
	5/3/2075	0			3.1	342			.54	
	5/3/2076	0			4.1	194			1.33	
	5/3/072A	0			2.3	35			.28	
	5/3/073A	0			2.9	27			1.79	
	5/3/074A	0			3.9	142	67	64872	2.97	24.2
	5/3/075A	0			4.7	18			.96	
	5/3/076A	0			4.8	18			.36	
	5/3/2077	0			9.3	49	59	376	2.53	15.4
	5/3/071C	0			10.9	60	56	505	2.86	14.0
	5/3/077A	0			8.6	109	69	1686	3.58	22.4
04-12	5/3/2078	0			3.8	49			.21	
	5/3/2079	0			5.8	9			.63	
	5/3/2080	0			4.4	19			1.02	
13-12	5/4/1	0	6.44.09	112.48.00	6.6	58			1.31	
	5/4/1	43			5.1	32			1.15	
11-12	5/4/2	0	6.22.07	112.58.03	4.4	19			.66	
	5/4/2	60			5.2	43			.26	
	5/4/3	0	5.30.03	112.53.02	4.2	20			.32	
	5/4/3	60			5.5	53			.24	
12-12	5/4/4	0	5.30.09	111.25.01	6.4	37			.25	
	5/4/4	60			4.1	22			.33	
	5/4/5	0	6.12.02	11.17.03	6.5	37			.88	
	5/4/5	40			8.1	39			1.49	

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
12-12	5/4/6	0	6.26.00	111.14.05	8.2	87	56	700	2.15	25.
	5/4/6	25								
13-12	5/4/7	0	6.34.08	112.06.04	5.0	18			.90	
	5/4/7	40			5.1	32			1.10	
14-12	5/4/8	0	6.46.01	113.18.02	5.5	17			.77	
	5/4/8	44			6.7	36			1.20	
	5/4/9	0	6.24.08	113.19.04	1.3	61			.94	
	5/4/9	40			4.3	21			.41	
	5/4/10	0	6.25.01	113.53.06	5.1	61			.26	
	5/4/10	70			5.0	62			.57	
	5/4/11	0	6.44.00	113.48.03	5.8	54			.85	
	5/4/11	40			7.5	42			1.00	
15-12	5/4/12	0	6.51.08	114.16.09	1.5	32			.84	
	5/4/12	70			8.2	40	73	854	1.54	29.
	5/4/13	0	6.32.08	114.20.07	1.2	63	77	484	1.74	27.6
	5/4/13	73			5.0	130			.60	
	5/4/14	0	6.02.07	114.19.00	1.2	49			.94	
	5/4/14	69			4.7	19			.40	
16-12	5/4/15	0	7.08.20	115.15.05	1.5	50			.48	
	5/4/15	105			6.7	24			.99	
17-12	5/4/16	0	7.23.08	113.14.05	1.5	25	90	400	.39	15.
	5/4/16	40			5.5	106			.27	
	5/4/17	0	7.26.01	113.37.02	1.2	63			.31	
	5/4/17	45			5.3	4			.45	
18-12	26.64/18	0	7.26.04	114.27.00	.6	55			.51	
	5.4.18	110			1.4	63			2.72	
	5/4/19	0	8.20.00	114.26.00	.9	34			.84	
	5/4/19	35			1.6	144			.74	
25-12	5/4/20	0	8.00.09	115.59.05	.9	38			.12	
		50								
		100								
		250								
		500								
		750								
		1000								
		1500								
		2000								
		3000								
		4000								
		5000								
		6000								
	5/4/21	0								
		30								
		85								
		150								
		270								
		500								
		750								
		1000								
		1500								
		2000								
		2500								
		3000								
		4175								

DATE	STATION	DEPTH	POS SB	POS EL	SPM	Cu A	Cu B	Mn A	Fe A	Fe B
	5/4/22	0								
		45								
		100								
		250								
		500								
		1000								
		1500								
	5/4/23	0								

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
2	0	0.41		0.82		1.20				7.10	6.58	
	45	0.48		1.17		1.44				10.80	7.20	
3	0	0.61		1.11		1.50				10.38	61.50	
	40	0.53		0.59		1.50				10.38	19.40	
5	0	0.31		1.28		1.33				7.04	102.	
	40	0.38		0.63		1.49				5.14	86.50	
6	0	0.46		1.11		1.64					145.	
	63	0.34		1.34		1.20				6.33	140.	
7	0	0.33		0.72		1.31				7.26	33.30	
	66	0.33		0.58		1.08				7.50	63.90	
8	0	0.34		0.70		1.42				3.33	23.30	
	70	0.25		0.64		1.30				2.50	121.	
9	0	0.40		0.71		1.33				2.27	144.	
	77	0.27		0.72		1.15				5.14	60.80	
10	0	0.18		0.79		1.04					176.	
	60	0.41		0.64		2.12					45.90	
	110	0.46		0.24		1.47					20.	
11	0	0.24		0.35		0.99					95.30	
	24	0.38		0.50		1.31				4.52	66.70	
12	0											
	25											
	100											
	250											
	500											
	750											
	1500											
	2000											
	2500											
	3000											
	3100											
14	0	0.22		0.64		1.34					255.	
	50											
	150											
	200											
	300											
	400											
	500											
	600											
	750											
	1000											
	1500											
	2000											
	2500											
	3000											
14	3500											
	4000											
	4500											
	5000											
18	0	0.31		0.67		0.94					39.40	
	50											
	100											
	250											
	400											
	750											
	1000											
	1200											

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
19	0	0.23		0.49		1.08					30.60	
21	0	0.17		0.73		0.96					33.30	
	90	0.46		0.33		3.39					150.	
22	0	0.08		0.32		0.45					84.80	
	53	0.26		0.44		1.22					56.30	
23	0	0.23		0.55		1.26					50.00	
	40	0.32		0.51		1.43					12.00	
24	0	0.19		0.78		1.08					45.80	
	60	0.29		0.96		1.07					78.30	
25	0	0.21		0.33		0.83					32.10	
	45	0.29		0.40		1.27					75.60	
26	0	0.31	57	1.20	100	1.23	55	947		16.06	132.	80
	17	0.70	47	0.53	100	1.13	63	638		13.21	25.34	92
5/2/1	0	0.56	62	0.28	96	0.93	69	197	73	18.83	4.27	100
5/2/2	0	0.64	71	0.23	97	1.12	76	222		12.94	9.12	100
5/2/3	0	0.65	72	0.19	100	1.04	75	208		12.08	13.87	100
5/2/4	0	0.56	68	0.21	100	0.80	73	141		13.40	4.43	100
5/2/5	0	0.55	62	0.16	100	0.66	71	319		13.82	17.89	100
5/2/6	0	0.55	69	0.23	100	0.77	75	257		12.78	17.51	100
5/2/7	0	0.73	72	0.19	98	1.03	72	474		14.53	47.94	100
5/2/8	0	0.67	76	0.16	98	0.75	68	310		13.06	22.50	93
5/2/9	0	0.43	51	0.32	100	0.52	69	249		13.91	17.04	100
5/2/10	0	0.51	68	0.22	100	0.45	60	259		14.21	16.55	100
5/2/11	0	0.60	76	0.31	100	0.64	65	685		15.84	36.52	100
5/2/12	0	0.53	67	0.18	100	0.49	63	531		14.14	24.61	100
5/2/13	0											
5/2/14	0	0.44	65	0.18	100	0.54	66	248		13.64	17.34	100
5/2/15	0											
5/2/16	0	0.56	67	0.24	100	0.55	61	444		16.21	10.78	100
5/2/17	0											
5/2/18	0	0.58	67	0.20	100	0.66	68	275		15.41	17.62	100
5/2/19	0											
5/2/20	0	0.61	73	0.17	100	0.59	66	340		15.20	29.51	100
5/2/21	0	0.61	72	0.22	100	0.64	65	459		15.17	48.88	100
5/2/22	0	0.63	73	0.21	100	0.57	68	384	73	14.45	17.97	100
5/2/23	0	0.74	72	0.27	100	0.85	71	436		15.36	48.79	100
5/2/24	0	0.56	73	0.28	100	0.86	75	375		12.25	28.93	100
5/2/25	0	0.62	72	0.13	90	0.88	70	183		13.00	23.98	100
5/2/26	0	0.58	70	0.12	100	0.72	69	195		15.53	21.01	89
5/2/27	0	0.59	74	0.13	100	0.75	73	253		12.50	20.94	94
5/2/28	0	0.53	67	0.27	100	0.77	74	221		13.12	12.98	100
5/2/29	0	0.44	68	0.26	100	0.76	77	176		10.97	27.00	89
5/2/30	0	0.54	72	0.24	100	0.67	71	610		13.70	34.64	100
5/2/31	0	0.55	72	0.27	100	0.63	77	422		16.35	21.74	100
5/2/32	0	0.51	72	0.19	100	0.57	68			12.93	22.70	80
5/2/33	0	.64	75	.28	100	.86	66	400		13.88	58.07	84
5/2/34	0	.60	70	.22	94	.51	71	500		14.78	13.62	89
5/2/35	0	.52	69	.20	100	.47	75	438		14.71	9.19	100
5/2/37	0	.48	50	.20	100	.43	63	350		15.38	5.58	100
5/2/39	0	.47	49	.24	100	.43	58	209		15.00	8.45	100
5/2/40	0	.45	49	.20	100	.43	56	213		15.72	16.83	100
5/2/41	0	.54	54	.27	100	.53	53	456		15.76	9.49	100
5/2/42	0	.69	42	1.18	100	1.65	72	252		17.58	13.87	100
5/2/43	0	.94	64	1.63	100	1.79	70	1500		13.82	22.06	100
5/2/44	0	1.07	65	1.75	100	2.19	69	1018		14.47	46.49	100
5/2/45	0											

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
5/2/46	0	.50				1.99				1.21	14.7	
5/2/47	0	.18				.90				3.88	44.4	
5/2/48	0	.22				1.08				3.78	199.	
5/2/49	0	.93	72	.66	100	2.10	87	226		9.9	2.12	100
5/2/50	0	.70	59	1.53	100	1.47	63	1849		15.68	25.15	84
5/2/51	0	.31		.34		1.46				12.26	104.	
5/2/52	0	.83		.68		1.87				5.78	9.44	
5/2/53	0	.31		.56		1.93				5.60		
5/2/54	0	.37				.71				7.22	2.64	
5/2/55	0	.05		1.04		2.56				15.29	25.	
5/2/56	0	.67	48	1.08	94	1.45	58			17.14	7.81	100
5/2/57	0	.59	67	.95	100	2.33	73			14.57	11.21	100
5/2/58	0	.31		.35		1.79				8.97	20.7	
5/2/59	0	.24		.28		1.41				3.59	13.04	
5/2/60	0	.32		.54		1.82				7.32	10.4	
5/2/61	0	.17		.47		1.11				4.02	26.8	
5/2/62	0	1.65	34	1.03	100	1.46	64	282	85	15.53	7.22	100
5/2/64	0	.45	42	.52	100	1.13	58	232		19.40	6.12	86
5/2/66	0	.54	52	.37	100	1.14	70	263		14.05	12.01	100
5/2/68	0	.64	39	.72	100	1.18	68	441	85	16.06	6.22	100
5/2/70	0	.53	38	.42	99	1.19	61	220	71	21.73	1.63	100
5/2/71	0	.6	87	.32	100	1.22	80	408		14.62	24.62	100
5/2/73	0	.33	30	.66	98	.70	60	113	65	21.15	1.85	100
5/2/83	0	.70	50	.94	100	1.2	71	161	74	18.62	1.86	68
5/2/84	0	.74	51	.84	100	1.30	72	151	60	19.83	1.42	100
5/2/85	0	.74	53	.91	100	.40		223	75	17.83	4.52	100
5/2/86	0	.66	50	.75	100	1.25	65	746	86	12.93	2.99	100
5/2/87	0	.56	37	1.23	100	1.32	61	1142	89	14.30	16.37	29
5/2/88	0	.74	53	.74	100	1.41	61	665	76	16.03	84.76	99
5/2/89	0	.76	51	.82	100	1.40	64	998	73	15.23	26.66	94
5/2/90	0	.52	37	1.22	99	1.32	58	227	82		5.93	100
5/2/91	0	.74	64	.58	100	1.36	78	133		19.41	5.79	92
5/2/92	0	.87	74	1.24	100	1.78	83	161		9.54	1.89	85
5/2/93	0	.35		.45		1.92				5.51	30.4	
5/2/94	0	.82	72	1.45	100	.45	33	190	70	10.34	4.20	67
5/2/95	0	.81	72	1.22	100	1.71	84	263	79	10.04	2.90	100
5/2/96	0	.78	63	2.66	100	1.81	82	146	65	15.89	3.82	83
5/2/97	0	.62	55	1.59	100	1.21	74	168	70	14.51	6.99	78
5/2/98	0	1.13	75	1.89	100	1.05	71	268	80	14.01	3.02	74
5/2/99	0	.81	78	1.15	100	1.81	87	390	88	7.02	5.96	100
5/2/99B		.23	70	.49	100	.44	80			4.03	2.85	100
5/2/100	0	.76	75	1.03	100	1.41	82			8.38	3.72	100
5/2/100B		.64	56	1.05	100	1.75	81	477	94	14.52	1.87	100
5/2/101	0	.60	82	.73	100	1.33	84	331		9.75	6.12	100
5/2/101B		.74	63	.91	100	1.29	74	195	76	12.51	2.25	100
5/2/102	0	.82	80	.74	100	1.56	80	290		7.95	15.32	100
5/2/102B		.54	48	1.95	100	.99	63	210	80	15.06	1.74	100
5/2/103	0	.65	80	1.61	100	1.40	84	441		7.52	10.92	100
5/2/103B		.64	77	.95	100	1.90	89	299		7.33	8.43	78
5/2/104	0	.46	57	1.28	100	.91	68	899	90	10.85	8.80	92
5/2/104B		.51	49	1.09	100	1.13	74	275	85	11.49	7.55	55
5/2/105	0	.32	59	.77	100	1.57	70	312		7.07	14.78	42
5/2/105B		.41	46	1.55	100	.67	64	434	81	11.58	5.26	45
5/2/106	0	.72	74	1.85	100	1.26	32	794		13.82	36.21	67
5/2/106B		.44	50	1.96	100	.71	52	556		13.06	8.49	58
5/2/107	0	.49	73	1.11	100	1.98	76	343		8.93	43.3	27
5/2/108	0	.49	65	1.31	100	.96	68	611		10.38	6.63	62
5/2/109	0	.49	86	1.02	100	1.02	69	1417		8.19	22.22	100
5/2/110	0	.50	70	1.08	100	.96	67	407		10.39	4.90	100

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
5/2/111	0	.65	71	1.71	100	.80	59	457		14.78	11.43	100
5/2/112	0	1.64	71	2.1	100	2.71	78	641		15.00	8.84	100
5/2/113	0	.73	67	1.75	100	.87	62	375		15.10	8.93	100
5/2/114	0	1.05	92	1.76	100	.74	47	1727		17.12	36.36	100
5/2/115	0	1.57	58	1.60	100	.71	49	560		14.17	13.89	54
5/2/116	0	.91	70	2.53	100	.87	44	794		18.65	15.08	100
5/2/117	0	.86	77	2.47	93	.56	38	598		16.79	14.29	100
5/2/118	0	.53	49	2.13	100	1.63	40	290		17.36	3.62	100
5/2/119	0	.56	63	1.55	100	.64	44	329		15.28	10.17	65
5/2/120	0	.66	79	.92	100	1.05	65	242		15.52	19.38	100
5/2/121	0	.92	88	.51	100	1.39	81	476		8.39	18.21	100
5/2/122	0	.42	67	.37	100	.69	42	275		14.44	4.56	100
5/2/123	0	.66	80	.48	100	.71	55	1098		10.61	8.61	100
5/2/124A	0	.39	79	1.14	100	.61	41	368		9.64	14.70	100
5/2/124B	0	.57	89	.71	100	.35	34	289		10.00	14.93	100
5/2/124C	0	.91	86	1.18	100	.70	33	816		15.1	21.42	100
5/3/2001	0	.37	30	3.97	100	.59	37	214	63	19.91	2.41	73
5/3/2002	0	.45	42	3.58	100	.88	51	377	84	15.81	7.87	100
5/3/2003	0	.50	36	2.46	100	1.04	56	452	88	14.91	4.63	74
5/3/2004	0	.60	53	2.27	100	1.05	50	601	90	16.63	15.22	100
5/3/2005	0	.45	51	2.76	100	.96	56	430	70	14.46	9.77	100
5/3/2006	0	.46	52	2.10	100	1.07	55	308	97	5.37	7.01	67
5/3/2007	0	.58	60	1.42	100	1.24	57	349		15.66	11.52	100
5/3/2008	0	.43	44	2.16	100	.96	57	229		15.57	8.46	100
5/3/2009	0	.48	63	.89	100	.90	60	286		12.26	15.90	100
5/3/2010	0	.40	45	2.04	100	.99	56	216		12.76	6.72	100
5/3/2011	0	.31	29	1.80	100	.73	55	279		13.93	5.00	100
5/3/2012	0	.39	54	2.00	100	.85	46	373		13.81	10.05	74
5/3/2013	0	.41	41	2.20	100	.74	36	158		15.24	6.27	76
5/3/2014	0	.42	38	2.60	100	.92	36	193		17.15	5.37	76
5/3/2015	0											
5/3/2016	0											
5/3/2017	0	.26		2.00	100	1.09				15.50	3.69	
5/3/2018	0	.53	62	.90	100	.95	49	390		15.58	17.65	100
5/3/2019	0	.63	67	2.08	100	1.21	50	471		16.89	21.23	80
5/3/2020	0	.63	56	1.79	100	1.23	54	1121		18.08	13.46	82
5/3/2021	0	.45	44	2.34	100	.78	59	136		16.08	5.78	79
5/3/2022	0											
5/3/2023	0	.46	50	2.45	100	.64	26	283		15.91	35.62	95
5/3/2024	0											
5/3/2025	0	.48	44	.71	100	1.20	61	282		14.88	10.61	88
5/3/2027	0	.51	39	.98	100	1.27	57	171		16.63	11.92	90
5/3/2028	0	.54	39	.65	100	1.21	61	252		15.94	14.02	85
5/3/2029	0	.61	54	1.03	100	1.46	62	351		17.29	35.98	100
5/3/2030	0	.49	31	1.80	100	1.22	59	270		22.06	4.26	88
5/3/2031	0	.49	41	1.07	100	1.26	59	201		16.89	4.39	76
5/3/2032	0	.58	59	1.37	100	1.27	54	382		16.71	24.79	88
5/3/2033	0	.53	42	1.27	100	1.21	60	152		15.84	12.56	69
5/3/2034	0											
5/3/2035	0											
5/3/2036	0	.09	78	.50	94	.52	42	125	49	21.48	1.19	80
5/3/2037	0	.22	27	.52	93	.57	32	127	47	16.62	.84	81
5/3/2038	0	.23	26	.53	100	.51	41	108	36	16.68	.59	64
5/3/2039	0	.24	29	.50	100	.52	38	135	46	17.17	1.50	87
5/3/2040	0											
5/3/2041	0											
5/3/2042	0	.22	27	.62	97	.46	46	134	55	20.83	.85	67
5/3/2043	0	.09	56	.51	100	.92	92	90	73	6.61	.98	72

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
5/3/2044	0	.22	27	.32	96	.30	67	121	49	20.53	.59	69
5/3/2045	0											
5/3/2047	0	.64	42	.97	100	1.57	48	587	59		6.16	84
5/3/2048	0	.49	84	.16	98	1.09	85	175	75	13.37	4.59	90
5/3/2049	0	.26	15	1.51	99	.51	27	103	35	16.18	.72	74
5/3/2050	0	.21				.66					45.	
5/3/2051	0	.23	65	.13	100	.64	67	163	64	18.80	3.13	76
5/3/2052	0	.65	26	.16	68	1.08	39	294	39		3.75	69
5/3/2053	0	.32	72	.15	100	.77	77	204	62	12.44	9.27	89
5/3/2054	0	.28	64	.05	100	.59	59	205	64	15.00	6.99	80
5/3/2055	0	.24	63	.11	100	.57	70	132	61	13.50	4.94	89
5/3/2056	0	.44	86	.17	100	1.20	83	360	96	9.81	20.98	77
5/3/056A	0	.49	89	.20	100	.70	73			12.44	29.47	91
5/3/2057	0	.15		.17	100	.78				9.74	8.90	
5/3/2061	0	.24		.14	100	1.24				9.94	9.10	
5/3/2062	0	.20		.16	100	1.24				9.82	5.85	
5/3/2063	0	.23		.20	100	1.04				10.93	8.26	
5/3/2064	0	.23		.57	100	1.37				10.52	26.37	
5/3/2065	0	.23				1.45				3.39	11.50	
5/3/2066	0	.44				2.13				2.02	10.98	
5/3/2067	0	.26				1.81				5.47	23.30	
5/3/2068	0	.56	68	.67	100	1.51	75			9.49	16.67	
5/3/2069	0	.52	67	.85	100	1.29	63			11.03	24.41	
5/3/2070	0	.68	71	.42	100	1.38	70			12.21	12.49	
5/3/2071	0	.53	62	.34	100	1.17	66			12.87	9.79	
5/3/2072	0	.27		.56	100	2.02				3.96	7.33	
5/3/2073	0	.28		.68	100	2.13				2.97	16.13	
5/3/2074	0	.66	95	.06	100	.59	75	571		8.16	34.16	87
5/3/2075	0	.21		.62	100	1.26				8.39	8.81	
5/3/2076	0	.27		.19	100	1.43				7.32	5.46	
5/3/072A	0	.18		.23	100	1.13				7.17	9.74	
5/3/073A	0	.31		.14	100	1.57				9.66	24.48	
5/3/074A	0	.83	95	.58	100	1.70	61	1282		9.62	98.05	94
5/3/075A	0	.29		.21	100	1.70				5.96	16.15	
5/3/076A	0	.19		.79	100	1.35				4.90	7.73	
5/3/2077	0	.48	79	.30	100	1.00	68	301		8.87	9.35	100
5/3/071C	0	.47	68	.42	100	1.09	61	445		11.65	12.61	84
5/3/077A	0	.66	80	1.21	100	1.42	70	645		10.12	18.91	89
5/3/2078	0	.11				.68					8.47	
5/3/2079	0	.07				.45				5.17	3.86	
5/3/2080	0	.09				.59				9.09	6.20	
5/4/1	0	.22		.43		1.08					19.61	
5/4/1	43	.21		.44		1.40				5.49	10.12	
5/4/2	0					.52				3.18	16.14	
5/4/2	60	.14				1.18				17.60	9.90	
5/4/3	0	.18		.54		.93					33.00	
5/4/3	60	.20		.58		1.59					7.62	
5/4/4	0	.22		.55		1.72					9.58	
5/4/4	60	.18		.55		1.04					38.78	
5/4/5	0	.19		.55		1.23				5.38	9.43	
5/4/5	40	.24		.03		.74				8.64	12.37	
5/4/6	0	.77	74	.93	100	1.74	77	305		9.14	34.38	85
5/4/6	25											
5/4/7	0	.15		.36		.97				5.20	10.32	
5/4/7	40	.18		.37		1.18				5.88	8.22	
5/4/8	0	.17		.30		1.17				3.45	21.75	
5/4/8	44	.14		.28		1.11				4.48	6.25	
5/4/9	0	.10		.46		.76				19.23	15.74	
5/4/9	40	.09		.33		.76				3.26	7.49	

STATION	Depth	K A	K B	Ca A	Ca B	Mg A	Mg B	Zn A	Zn B	Si A	Cd A	Cd B
5/4/10	0	.11		.40		.83				2.75	58.37	
5/4/10	70	.12		.45		.78					14.20	
5/4/11	0	.16		.35		1.03					151.90	
5/4/11	40	.21		.39		1.21					62.61	
5/4/12	0	.17		.37		1.10					8.40	
5/4/12	70	.50	78	1.12	100	1.45	79			5.18	19.89	80
5/4/13	0	.77	84	.94	100	1.88	79			6.85	32.57	79
5/4/13	73	.16		.38		.90				7.50	47.	
5/4/14	0	.15		.68		.98				4.92	13.25	
5/4/14	69	.09		.45		.72				3.19	8.91	
5/4/15	0	.15		.75		1.42				6.25	24.80	
5/4/15	105	.21		.32		1.21				4.93	12.06	
5/4/16	0	.47	93	.40	92	1.07	76	227		5.33	21.62	80
5/4/16	40	.10		.41		1.00				3.27	44.73	
5/4/17	0	.08		.47		.81				3.75	134.29	
5/4/17	45	.24		.40		1.23				3.77	9.74	
26.64/18	0	.20		1.11		1.24				8.10	34.55	
5.4.18	110	.41		1.27		3.25				16.79	43.79	
5/4/19	0	.20		.68		1.91				5.00	31.66	
5/4/19	35	.47		1.56		3.75				9.38	62.63	
5/4/20	0	.30		.84		1.43				5.60	104.88	
	50											
	100											
	250											
	500											
	750											
	1000											
	1500											
	2000											
	3000											
	4000											
	5000											
	6000											
5/4/21	0											
	30											
	85											
	150											
	270											
	500											
	750											
	1000											
	1500											
	2000											
	2500											
	3000											
	4175											
5/4/22	0											
	45											
	100											
	250											
	500											
	1000											
	1500											
5/4/23	0											

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
2	0	1.12		120		97		68	
	45	1.70		256		98		80	
3	0	1.63		385		254		125	
	40	1.87		440		125		237	
5	0	.69		287		352		107	
	40	.50		255		88		132	
6	0	.57		430		158		75	
	63	.82		323		151		62	
7	0	1.01		148		132		26	
	66	.51		213		114		66	
8	0			192		88		48	
	70			314		145		123	
9	0			138		65		169	
	77	.99		447		116		553	
10	0			394		122		44	
	60			188		81		51	
	110			313		123		163	
11	0			128		76		59	
	24	1.15		206		58		104	
12	0								
	25								
	100								
	250								
	500								
	750								
	1500								
	2000								
	2500								
	3000								
	3100								
14	0			202		40		22	
	50								
	150								
	200								
	300								
	400								
	500								
	600								
	750								
	1000								
	1500								
	2000								
	2500								
	3000								
14	3500								
	4000								
	4500								
	5000								
18	0			167		86		88	
	50								
	100								
	250								
	400								
	750								
	1000								
	1200								
19	0			135		33		18	
21	0			346		1402		44	

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
	90	2.73		432		3727		182	
22	0			139		61		18	
	53			148		89		41	
23	0			489				31	
	40			139		115		33	
24	0			137		67		88	
	60			459		152		76	
25	0	.94		285		105		103	
	45	1.46		546		100		89	
26	0	6.29	2	487	50	139	60	207	30
	17	5.66	3	278	56	149	19	138	32
5/2/1	0	6.28	11	32	31	27	47	55	31
5/2/2	0	6.70	14	54	48	40	57	68	49
5/2/3	0	6.20	13	56	52	35	40	37	38
5/2/4	0	7.15	11	68	63	41	51	65	62
5/2/5	0	6.87	11	61	56	36	48	64	31
5/2/6	0	6.25	8	107	49	34	54		
5/2/7	0	6.08	11	344	64	46	61	73	25
5/2/8	0	6.34	9	203	68	52	48	61	30
5/2/9	0	6.94	4	115	75	57	54	59	61
5/2/10	0	7.34	6	103	57	33	57	43	19
5/2/11	0	7.25	7	132	63	62	63	71	65
5/2/12	0	7.39	7	121	66	66	65	75	45
5/2/13	0								
5/2/14	0	7.04	8	93	47	32	22	40	18
5/2/15	0								
5/2/16	0	7.66	4	103	54	39	44	51	37
5/2/17	0								
5/2/18	0	7.86	7	130	47	46	41	118	50
5/2/19	0								
5/2/20	0	7.66	5	126	57	58	48	51	51
5/2/21	0	7.75	9	182	70	65	48	87	20
5/2/22	0	6.77	4	98	54	50	42	49	27
5/2/23	0	7.46	6	97	49	66	50	44	34
5/2/24	0	5.96	4	118	62	38	24	36	28
5/2/25	0	6.66	14	132	59	55	29	64	41
5/2/26	0	6.97	13	84	47	82	44	43	33
5/2/27	0	6.10	11	105	56	74	44	40	20
5/2/28	0	6.32	3	100	53	56	49	34	18
5/2/29	0	5.97	17	145	69	61	56	27	48
5/2/30	0	6.38	4	181	69	96	67	46	11
5/2/31	0	6.34	4	205	76	206	76	34	18
5/2/32	0	6.31	5	265	78	65	57	32	22
5/2/33	0	6.58	4	248	67	202	48	62	16
5/2/34	0	7.76	4	214	74	214	54	54	35
5/2/35	0	7.69	6	180	71	140	67	65	15
5/2/37	0	7.59	6	127	68	36	17	36	22
5/2/39	0	7.46	3	130	68	61	66	30	40
5/2/40	0	7.95	6	145	100	84	55	54	19
5/2/41	0	7.73	4	102	68	75	58	37	19
5/2/42	0	6.97	7	147	70	124	44	91	25
5/2/43	0	5.77	2	227	81	287	77	79	22
5/2/44	0	5.95	4	257	60	284	62	123	35
5/2/45	0								
5/2/46	0	.20		12		30		20	
5/2/47	0			154		392		46	
5/2/48	0			100		32		30	
5/2/49	0	4.44	9	31	32	60	25	54	25

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
5/2/50	0	6.41	2	126	29	163	23	157	18
5/2/51	0	3.64				88		42	
5/2/52	0	.58		86		56		61	
5/2/53	0			135		69		48	
5/2/54	0			122		33		6	
5/2/55	0			494		71		17	
5/2/56	0	5.86	4	116	58	73	65	102	43
5/2/57	0	4.4		147	52	67	64	75	37
5/2/58	0	.90		198		48		19	
5/2/59	0			166		26		34	
5/2/60	0	1.76		230		121		89	
5/2/61	0	.63		351		85		22	
5/2/62	0	6.21	4	86	27	65	29	95	15
5/2/64	0	6.11	4	52	46	64	60	145	59
5/2/66	0	6.15	14	123	55	70	56	104	39
5/2/68	0	6.55	5	74	37	77	53	115	26
5/2/70	0	6.71	8	49	45	50	40	85	28
5/2/71	0	3.48	3	140	37	216	86	102	34
5/2/73	0	7.57	8	32	32	27	33	39	26
5/2/83	0	4.89	6	33	30	45	51	84	35
5/2/84	0	4.94	5	40	31	38	34	68	17
5/2/85	0	4.33	5	45	30	42	22	64	11
5/2/86	0	5.85	11	99	38	51	27	88	17
5/2/87	0	5.65	5	110	53	205	20		
5/2/88	0	6.45	5	180	52	150	48	109	22
5/2/89	0	6.62	8	109	53	74	43	106	18
5/2/90	0	7.46	2	56	60	57	32	43	19
5/2/91	0	5.72	9	39	46	28	50	65	26
5/2/92	0	4.14	5	34	35	42	26	74	12
5/2/93	0	1.12		104		50		32	
5/2/94	0	3.86	5	42	32	60	47	80	28
5/2/95	0	3.67		37	47	39	51	60	28
5/2/96	0	4.72	6	23	36	42	50	60	17
5/2/97	0	5.10	10	34	37	30	47	64	22
5/2/98	0	4.83	8	35	40	37	24		
5/2/99	0	2.93	4	28	38	54	17	144	8
5/2/99B		1.54	15	33	59	13	46	25	36
5/2/100	0	3.70	7	69	23	30	43	55	27
5/2/100B		5.32	10	65	36	37	35	78	33
5/2/101	0	3.06	15	84	41	43	42	66	36
5/2/101B		5.47	8	60	30	31	23	67	22
5/2/102	0	3.55	6	100	34	46	43	71	32
5/2/102B		4.89	4	47	28	31	35	60	18
5/2/103	0	3.53	12	155	51	61	67	63	27
5/2/103B		3.45	11	59	43	43	67	49	22
5/2/104	0	4.54	12	129	56	64	61	73	34
5/2/104B		5.20	15	97	42	52	48	70	24
5/2/105	0	2.95	14	139	44	61	49	47	42
5/2/105B		5.02	13	87	38	46	43	93	14
5/2/106	0	4.93	3	215	56	135	60	104	38
5/2/106B		5.18	3	160	44	64	45	77	14
5/2/107	0	3.85	13	300	45	54	63	88	25
5/2/108	0	4.47	13	179	44	66	61	65	31
5/2/109	0	3.61	23	319	38	121	48	220	15
5/2/110	0	4.47	17	125	51	90	46	96	29
5/2/111	0	4.85	15	267	50	153	39	137	37
5/2/112	0	9.44	13	82	40	61	38	121	23
5/2/113	0	5.14	4	136	63	80	56	67	28
5/2/114	0	5.25	12	482	55	506	55	260	26
5/2/115	0	5.01	9	188	49	92	68	87	32
5/2/116	0	6.35	5	261	49	243	32	123	39
5/2/117	0	5.52	6	438	61	128	48	147	27
5/2/118	0	6.13	5	150	36	70	57	123	23
5/2/119	0	5.21	6	165	46	74	61	53	13
5/2/120	0	5.47	9	174	44	111	74	79	15
5/2/121	0	3.15	19	452	79	215	91	55	36
5/2/122	0	7.10	9	194	56	76	76	58	21

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
5/2/123	0	5.37	18	223	70	248	91	166	64
5/2/124A	0	2.95	4	365	72	223	87	102	39
5/2/124B	0	2.53		249	69	97	77	94	36
5/2/124C	0	4.08		438	61			183	15
5/3/2001	0	6.06	4	64	46	54	37	65	8
5/3/2002	0	6.60	7	133	49	179	78	116	14
5/3/2003	0	6.43	3	85	40	87	56	121	4
5/3/2004	0	7.57	7	199	53	116	66	125	14
5/3/2005	0	6.42	6	152	68	102	64	119	11
5/3/2006	0	3.05	13	97	68	76	71	87	20
5/3/2007	0	7.08	7	233	58	177	77	102	18
5/3/2008	0	6.55	4	131	70	76	53	75	11
5/3/2009	0	5.47	5	250	77	71	59	90	13
5/3/2010	0	5.73	3	132	50	83	72	69	12
5/3/2011	0	6.43	7	197	44	84	73	77	13
5/3/2012	0	6.47	4	97	74	82	61	44	32
5/3/2013	0	7.00	4	92	71	68	56	58	14
5/3/2014	0	7.96	4	163	67	84	55	72	15
5/3/2015	0								
5/3/2016	0								
5/3/2017	0	6.64		44		28		54	
5/3/2018	0	7.15	4	423	64	107	71	66	26
5/3/2019	0	6.13	6	315	63	165	56	112	36
5/3/2020	0	8.13	3	113	63	134	78	74	23
5/3/2021	0	6.99	4	102	66	98	71	54	17
5/3/2022	0								
5/3/2023	0	6.61	3	544	93	116	68	85	12
5/3/2024	0								
5/3/2025	0	6.31	6	152	81	55	58	76	18
5/3/2027	0	7.00	5	165	79	88	64	95	29
5/3/2028	0	6.71	7	164	83	97	67	123	24
5/3/2029	0	7.44	6	190	84	100	73	132	24
5/3/2030	0	6.67	5	91	76	75	61	82	24
5/3/2031	0	7.21	5	77	62	53	40	71	15
5/3/2032	0	7.10	4	283	82	100	72	113	19
5/3/2033	0	6.36	4	74	66	68	51	76	17
5/3/2034	0								
5/3/2035	0								
5/3/2036	0	6.77	5	31	48	17	29	37	14
5/3/2037	0	6.46	4	29	58	17	24	21	5
5/3/2038	0	6.93	4	18	41	17	12	22	5
5/3/2039	0	6.96	5	24	52	15	20	22	14
5/3/2040	0								
5/3/2041	0								
5/3/2042	0	6.38	8	27	54	16	31	23	17
5/3/2043	0	2.69	7	14	60	9	44	8	13
5/3/2044	0	7.28	7	26	58	122	17	20	15
5/3/2045	0								
5/3/2047	0			123	63	73	37	131	25
5/3/2048	0	5.61	6	34	60	24	58	24	33
5/3/2049	0	5.88	5	27	40			35	6

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
5/3/2050	0	1.25		143		69		101	
5/3/2051	0	6.51	6	55	46	46	48	44	25
5/3/2052	0			58	26	35	20	45	7
5/3/2053	0	7.43	14	66	71	35	83	50	76
5/3/2054	0	7.77	6	266	79	71	89	63	71
5/3/2055	0	6.31	7	81	84	30	70	21	33
5/3/2056	0	5.28	13	105	72	60	83	29	21
5/3/056A	0	3.35	10	300	84	65	98	88	84
5/3/2057	0	.45		34		20		22	
5/3/2061	0	1.09		76		38		37	
5/3/2062	0	1.18		46		66		16	
5/3/2063	0	1.26		65		23		43	
5/3/2064	0	2.24		141		42		76	
5/3/2065	0	.11		151		134		15	
5/3/2066	0	.06		90		28		19	
5/3/2067	0	.02		363		2		21	
5/3/2068	0	4.10	23	121	83	89	91	51	33
5/3/2069	0	4.27	4	139	83	89	63	82	16
5/3/2070	0	4.51	4	134	62	50	82	47	28
5/3/2071	0	4.39	4	92	80	37	81	40	15
5/3/2072	0	.13		88		196		76	
5/3/2073	0	.09		130		3		32	
5/3/2074	0	3.32	6	317	90	119	96	67	19
5/3/2075	0			85				33	
5/3/2076	0	1.34		64				25	
5/3/072A	0			114				26	
5/3/073A	0	1.69		55				35	
5/3/074A	0	4.49	6	263	75	292	100	43	40
5/3/075A	0	1.04		328		33		23	
5/3/076A	0	.06		112		30		14	
5/3/2077	0	3.46	6	107	62	55	67	32	22
5/3/071C	0	4.12	4	253	81	108	79	43	23
5/3/077A	0	4.95	12	383	80	137	85	61	39
5/3/2078	0			252		49		7	
5/3/2079	0	.45		92		18		4	
5/3/2080	0	1.11		110		30		25	
5/4/1	0	1.82		1237		54		57	
5/4/1	43	1.67		223		20		33	
5/4/2	0	.45		206		32		25	
5/4/2	60			205		165		85	
5/4/3	0			1148		53		26	
5/4/3	60			155		72		27	
5/4/4	0			100		17		23	
5/4/4	60			234		60		47	
5/4/5	0	1.03		196		34		23	
5/4/5	40	2.16		92		31		51	
5/4/6	0	3.05	4	219	50	262	84	69	33
5/4/6	25								
5/4/7	0	1.10		168		10		67	
5/4/7	40	1.65		146		27		33	
5/4/8	0	.89		98		22		23	
5/4/8	44	1.25		89		34		99	
5/4/9	0	.51		431		54		85	
5/4/9	40	.23		111		24		39	
5/4/10	0	.20		1445		27		74	
5/4/10	70	.52		490		57		50	
5/4/11	0	1.03		2686		40		29	
5/4/11	40	1.27		2699		53		50	

STATION	DEPTH	Al A	Al B	Pb A	Pb B	Ni A	Ni B	Cr A	Cr B
5/4/12	0	.99		349		40		46	
5/4/12	70	1.83	13	248	74	141	99	97	25
5/4/13	0	2.10	15	133	55	169	67	227	14
5/4/13	73	.40		552		96		67	
5/4/14	0	1.19		261		48		170	
5/4/14	69	.43		125		57		25	
5/4/15	0	.62		107		40		19	
5/4/15	105	1.27		720		71		207	
5/4/16	0	.33		166	66	32		45	13
5/4/16	40	.18		925		34		29	
5/4/17	0	.21		2307		56		42	
5/4/17	45	.28		330		46		22	
26.64/18	0	.34		129		65		70	
5.4.18	110	1.79		1516		116		145	
5/4/19	0	.53		1905		46		52	
5/4/19	35	.63		366		102		181	
5/4/20	0			808		808		132	
	50								
	100								
	250								
	500								
	750								
	1000								
	1500								
	2000								
	3000								
	4000								
	5000								
	6000								
5/4/21	0								
	30								
	85								
	150								
	270								
	500								
	750								
	1000								
	1500								
	2000								
	2500								
	3000								
	4175								
5/4/22	0								
	45								
	100								
	250								
	500								
	1000								
	1500								
5/4/23	0								

Table XI

Concentration of the elemental content in the suspended matter in all regions expressed as $ug.l^{-1}$. This means the contribution of elements in suspended matter to one liter water sample.

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
2	0	.37	.01	.20	.16	.11	
2	45	.45	.01	.29	.11	.09	
3	0	.46	.06	.40	.26	.13	1.31
3	40	.74	.02	.52	.15	.28	
5	0	1.01	.12	.35	.48	.15	
5	40	.73	.15	.43	.15	.22	.42
6	0	.68	.13	.38	.14	.07	1.15
6	63	.62	.17	.39	.18	.08	
7	0	.38	.07	.30	.27	.05	
7	66	.24	.10	.35	.19	.11	
8	0	.44	.03	.26	.13	.07	
8	90	.57	.23	.60	.28	.23	
9	0	.19	.12	.27	.13	.33	
9	77	.42	.10	.69	.18	.85	
10	0	.41	.18	.40	.12	.04	
10	60	1.54	.25	1.05	.46	.28	
10	110	.5	.03	.45	.18	.23	.81
11	0	.49	.20	.25	.15	.12	
11	24	1.25	.13	.40	.11	.20	
14	0	.17	.36	.26	.05	.31	
18	0	.23	.05	.25	.13	.13	
19	0	.85	.05	.23	.06	.03	
21	0	.46	.04	.32	1.72	.05	
21	90	.92	.16	.53	3.90	.19	
22	0	.27	.11	.18	.08	.02	
22	53	.55	.09	.23	.14	.06	
23	0	.95	.08	.51		.05	
23	40	.49	.03	.32	.26	.09	
24	0	.20	.05	.19	.07	.10	
24	60	.38	.08	.42	.14	.07	
25	0	.48	.06	.50	.19	.18	
25	45	1.07	.14	1.02	.19	.17	
26	0	.90	.40	1.47	.42	.63	
26	17	1.28	.11	1.24	.61	.62	
5/2/1	0	2.20	.23	1.73	1.51	3.00	10.63
5/2/2	0	3.79	.29	1.71	1.26	2.18	
5/2/3	0	2.25	.24	.98	.61	.65	
5/2/4	0	2.48	.11	1.61	.97	1.55	
5/2/5	0	2.84	.37	1.25	.72	1.1	
5/2/6	0	3.30	.42	2.54	.79	.55	
5/2/7	0	3.94	.93	6.68	1.08	1.42	
5/2/8	0	4.40	.49	4.4	1.12	1.22	
5/2/9	0	2.79	.31	2.06	.88	1.03	
5/2/10	0	3.64	.46	2.86	.94	1.17	
5/2/11	0	3.18	.65	2.35	1.09	1.26	
5/2/12	0	4.46	.63	3.10	1.68	1.92	
5/2/14	0	4.08	.58	3.11	1.07	1.29	
5/2/16	0	4.42	.25	2.40	.90	1.18	
5/2/18	0	4.08	.43	3.18	1.13	2.90	
5/2/20	0	4.30	.72	3.08	1.43	1.26	

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
5/2/21	0	3.52	1.05	4.08	1.43	1.96	
5/2/22	0	4.68	.46	2.53	1.28	1.26	9.84
5/2/23	0	3.64	1.21	2.40	1.65	1.12	
5/2/24	0	4.78	.81	3.30	1.07	1.01	
5/2/25	0	3.44	.49	3.25	1.36	1.40	
5/2/26	0	2.82	.37	1.52	1.45	.78	
5/2/27	0	2.76	.34	1.69	1.17	.65	
5/2/28	0	2.91	.24	1.81	1.01	.60	
5/2/29	0	3.76	.45	2.40	1.01	.45	
5/2/30	0	5.84	.88	4.61	2.45	1.19	
5/2/31	0	3.02	.50	4.73	4.72	.79	
5/2/32	0	4.36	.50	5.88	1.45	.72	
5/2/33	0	4.06	2.38	10.18	8.26	2.52	
5/2/34	0	4.74	.32	4.97	4.98	1.25	
5/2/35	0	4.34	.25	4.89	3.80	1.77	
5/2/37	0	5.14	.22	5.02	1.43	1.41	
5/2/39	0	5.14	.36	5.55	2.60	1.27	
5/2/40	0	5.36	.68	5.88	3.38	2.20	
5/2/41	0	3.52	.30	3.22	2.40	1.17	
5/2/42	0	1.13	.22	2.28	1.93	1.43	
5/2/43	0	1.07	.15	3.86	1.95	.54	
5/2/44	0	.67	.27	1.47	1.62	.73	
5/2/46	0	.52	.26	.21	.52	.35	
5/2/47	0	.38	.16	.56	1.41	.17	
5/2/48	0	.24	.74	.37	.12	.11	
5/2/49	0	1.29	.07	.96	1.82	1.65	
5/2/50	0	.92	.17	.84	1.08	1.04	
5/2/51	0	.49	.44		.37	.18	
5/2/52	0	.34	.04	.39	.25	.28	
5/2/53	0	.48		.57	.29	.20	
5/2/54	0	.32	.01	.44	.12	.02	
5/2/55	0	.51	.04	.84	.12	.02	
5/2/56	0	.57	.07	1.01	.66	.95	
5/2/57	0	.53	.05	.69	.31	.35	
5/2/58	0	.64	.05	.53	.13	.05	
5/2/59	0	.62	.05	.70	.11	.15	
5/2/60	0	.78	.04	.86	.45	.34	
5/2/61	0	.66	1.00	1.31	.32	.08	
5/2/62	0	1.55	.13	1.55	1.18	1.80	
5/2/64	0	2.14	.19	1.60	1.93	2.95	8.37
5/2/66	0	1.61	.22	2.21	1.26	1.84	
5/2/68	0	1.43	.12	1.44	1.50	2.45	8.52
5/2/70	0	4.43	.09	2.57	2.63	4.20	11.42
5/2/71	0	.53	.16	.92	1.40	3.57	
5/2/73	0	6.70	.33	7.15	6.08	8.58	25.16
5/2/83	0	1.88	.09	1.53	2.09	3.61	7.48
5/2/84	0	2.63	.08	2.18	2.08	3.79	8.23
5/2/85	0	2.50	.24	2.43	2.24	3.56	11.88
5/2/86	0	.94	.05	1.51	.77	1.32	11.33
5/2/87	0	.76	.14	.95	1.76		9.78

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
5/2/88	0	.95	.83	1.52	1.46	1.54	6.47
5/2/89	0	1.04	.27	1.07	.72	1.16	9.80
5/2/90	0	1.19	.14	1.28	1.31	1.22	5.83
5/2/91	0	3.27	.21	1.40	1.36	2.22	
5/2/92	0	1.47	.05	.77	1.52	1.71	
5/2/93	0	.55	.14	.46	.23	.15	
5/2/94	0	1.45	.09	.95	1.38	1.98	4.33
5/2/95	0	1.09	.06	.81	.86	1.40	6.75
5/2/96	0	2.24	.15	.86	1.56	2.24	5.46
5/2/97	0	2.28	.31	1.49	1.30	2.86	7.44
5/2/98	0	1.75	.20	2.44	2.60		18.59
5/2/99	0	.81	.15	.72	1.40	4.94	10.11
5/2/99B	0	1.14	.11	1.32	.53	.99	
5/2/100	0	1.62	.06	1.18	.53	.93	
5/2/100B	0	2.21	.07	2.51	1.45	3.03	18.52
5/2/101	0	.66	.08	1.07	.55	.83	
5/2/101B	0	1.70	.07	1.94	1.02	2.18	6.33
5/2/102	0	.63	.17	1.13	.53	.80	
5/2/102B	0	2.11	.08	2.10	1.40	2.66	9.32
5/2/103	0	.88	.12	1.68	.68	.68	
5/2/103B	0	.79	.21	1.47	1.07	1.22	
5/2/104	0	1.10	.11	1.66	.82	.94	11.52
5/2/104B	0	1.34	.15	1.95	1.05	1.41	5.53
5/2/105	0	1.13	.25	2.36	1.03	.80	
5/2/105B	0	1.24	.10	1.66	.47	1.76	8.24
5/2/106	0	.92	.22	1.33	.84	.65	
5/2/106B	0	1.19	.11	2.06	.83	.99	
5/2/107	0	.84	.52	3.64	.67	1.02	
5/2/108	0	.87	.07	1.86	.71	.68	
5/2/109	0	1.80	.27	3.84	1.86	2.64	
5/2/110	0	.84	.05	1.27	.91	.98	
5/2/111	0	1.13	.08	1.87	1.08	.96	
5/2/112	0	2.83	.27	2.46	1.82	3.87	
5/1/113	0	2.03	.21	3.17	1.89	1.56	
5/2/114	0	1.71	.20	2.61	2.79	1.45	
5/2/115	0	1.98	.29	3.94	1.95	1.84	
5/2/116	0	2.07	.16	2.74	2.55	1.28	
5/2/117	0	1.02	.13	4.08	1.20	1.38	
5/2/118	0	2.87	.08	5.40	1.60	2.82	
5/2/119	0	1.60	.16	2.37	1.06	.76	
5/2/120	0	1.10	.19	1.69	1.09	.77	
5/2/121	0	.97	.15	3.80	1.85	.56	
5/2/122	0	4.15	.10	4.43	1.14	1.32	
5/2/123	0	4.82	.14	3.63	4.06	2.70	
5/2/124A	0	1.02	.16	5.06	3.03	1.43	
5/2/124B	0	.97	.18	3.03	1.19	1.14	
5/2/124C	0	1.07	.18	3.59		1.50	
5/3/2001	0	2.97	.11	2.92	2.47	2.93	9.74
5/3/2002	0	5.38	.28	4.68	6.30	4.06	13.25
5/3/2003	0	3.51	.12	2.33	2.36	3.30	12.36

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
5/3/2004	0	3.01	.23	3.06	1.79	1.92	9.21
5/3/2005	0	3.29	.21	3.30	2.22	2.56	9.32
5/3/2006	0	2.63	.17	2.42	1.88	2.16	7.65
5/3/2007	0	1.99	.19	3.86	2.93	1.70	
5/3/2008	0	3.48	.25	4.41	2.22	2.19	
5/3/2009	0	2.85	.31	4.88	1.39	1.55	
5/3/2010	0	2.55	.13	2.08	1.62	1.33	
5/3/2011	0	2.96	.12	2.78	1.87	1.80	
5/3/2012	0	1.73	.21	2.05	1.73	.93	
5/3/2013	0	2.12	.18	2.59	1.90	1.62	
5/3/2014	0	3.19	.12	3.73	1.94	1.65	
5/3/2015							
5/3/2016							
5/3/2017	0	.27	.04	.45	.29	.56	
5/3/2018	0	1.64	.20	4.79	1.22	.75	
5/3/2019	0	1.60	.19	2.78	1.47	1.82	
5/3/2020	0	2.56	.21	1.72	2.04	2.30	
5/3/2021	0	2.56	.14	2.45	2.34	2.57	
5/3/2022							
5/3/2023	0	4.62	1.77	11.93	5.71	4.18	
5/3/2024							
5/3/2025	0	.99	.18	2.61	.94	1.32	
5/3/2027	0	1.12	.21	2.93	1.58	1.69	
5/3/2028	0	1.04	.22	2.55	1.50	1.91	
5/3/2029	0	.73	.39	2.03	1.07	1.42	
5/3/2030	0	2.94	.26	5.45	4.47	4.89	
5/3/2031	0	2.71	.19	3.28	2.30	3.01	
5/3/2032	0	.90	.32	3.58	1.27	1.44	
5/3/2033	0	1.79	.39	2.28	2.09	2.33	
5/3/2036	0	33.81	.53	13.54	8.76	11.69	54.83
5/3/2037	0	55.69	.65	22.36	12.73	16.47	98.76
5/3/2038	0	59.30	.51	16.06	11.20	19.39	98.42
5/3/2039	0	51.53	.99	16.28	10.22	14.65	86.79
5/3/2042	0	58.38	.64	19.78	11.84	17.19	100.37
5/3/2043	0	33.17	.84	13.5	7.21	7.31	76.12
5/3/2044	0	54.09	.36	15.69	7.60	12.14	73.60
5/3/2045	0						
5/3/2047	0	12.81	.24	4.71	2.85	5.06	22.63
5/3/2048	0	10.24	.71	5.36	3.77	3.58	27.21
5/3/2049	0	112.58	1.39	51.75	11.25	68.75	198.65
5/3/2050	0	.54	.34	10.74	.53	.77	
5/3/2051	0	3.22	.12	1.99	1.63	1.56	5.83
5/3/2052	0	9.64	.23	3.60	2.14	2.75	18.07
5/3/2053	0	2.53	.26	1.80	.94	1.37	5.53
5/3/2054	0	2.94	.24	8.80	2.33	2.08	6.78
5/3/2055	0	4.67	.24	3.81	1.42	.99	6.21
5/3/2056	0	1.27	.23	1.13	.64	.32	3.89
5/3/2057	0	.32	.05	.20	.12	.13	
5/3/205A	0	1.35	.26	2.74	.57	.78	
5/3/2061	0	.62	.07	.59	.29	.29	

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
5/3/2062	0	.29	.03	.25	.04	.09	
5/3/2063	0	.15	.03	.25	.09	.17	
5/3/2064	0	.50	.10	.54	.16	.29	
5/3/2065	0	.36	.03	.42	.38	.04	
5/3/2066	0	.71	.05	.42	.13	.09	
5/3/2067	0	.22	.10	1.56	.01	.09	
5/3/2068	0	1.07	.13	.95	.70	.40	
5/3/2069	0	.93	.17	.95	.61	.56	
5/3/2070	0	1.21	.13	1.37	.51	.49	
5/3/2071	0	1.33	.12	1.06	.43	.46	
5/3/2072	0	.08	.02	.21	.47	.18	
5/3/2073	0	.43	.05	.42	.01	.10	
5/3/2074	0	.75	.17	1.56	.58	.33	
5/3/2075	0	1.06	.03	.26		.10	
5/3/2076	0	.80	.02	.26		.10	
5/3/072A	0	.80	.02	.26		.06	
5/3/073A	0	.08	.07	.16		.10	
5/3/074A	0	.55	.38	1.03	1.14	.17	
5/3/075A	0	.08	.08	1.54	.15	.11	
5/3/076A	0	.08	.04	.54	.14	.07	
5/3/071C	0	.66	.14	2.77	1.18	.47	
5/3/2077	0	.46	.09	1.03	.52	.30	
5/3/077A	0	.94	.17	3.29	1.18	.53	
5/3/2078	0	.19	.03	.96	.19	.03	
5/3/2079	0	.05	.02	.54	.11	.03	
5/3/2080	0	.08	.03	.48	.13	.11	
5/4/1	0	.39	.13	8.17	.36	.38	
5/4/1	43	.16	.05	1.14	.10	.17	
5/4/2	0	.08	.07	.91	.14	.11	
5/4/2	60	.22	.05	1.07	.86	.44	
5/4/3	0	.08	.14	4.82	.22	.11	
5/4/3	60	2.29	.04	.85	.40	.15	
5/4/4	0	.24	.06	.64	.11	.15	
5/4/4	60	.09	.16	.96	.25	.19	
5/4/5	0	.24	.06	1.28	.22	.15	
5/4/5	40	.31	.10	.75	.25	.42	
5/4/6	0	.71	.28	1.79	2.16	.57	
5/4/6	25	1.02	.25	2.45	1.41	1.12	
5/4/7	0	.09	.05	.84	.05	.33	
5/4/7	40	.16	.04	.75	.14	.17	
5/4/8	0	.09	.12	.54	.12	.13	
5/4/8	44	.24	.04	.60	.23	.67	
5/4/9	0	.08	.02	.56	.07	.11	
5/4/9	40	.09	.03	.48	.10	.17	
5/4/10	0	.31	.30	7.37	.14	.38	
5/4/10	70	.31	.07	2.46	.29	.25	
5/4/11	0	.31	.88	15.58	.23	.17	
5/4/11	40	.31	.47	20.24	.4	.38	
5/4/12	0	.05	.01	.51	.06	.07	
5/4/12	70	.33	.16	2.03	1.57	.80	

STATION	DEPTH	Cu	Cd	Pb	Ni	Cr	Zn
5/4/13	0	.08	.04	.16	.21	.28	
5/4/13	73	.65	.24	2.76	.48	.33	
5/4/14	0	.06	.02	.32	.06	.21	
5/4/14	69	.09	.04	.59	.27	.12	
5/4/15	0	.08	.04	.16	.06	.03	
5/4/15	105	.16	.08	4.82	.48	1.38	
5/4/16	0	.03	.04	.25	.21	.10	
5/4/16	40	.58	.25	5.09	.19	.16	
5/4/17	0	.08	.16	2.77	.07	.05	
5/4/17	45	.02	.05	1.75	.24	.12	
5/4/18	0	.04	.02	.08	.04	.05	
5/4/18	110	.09	.06	2.12	.16	.20	
5/4/19	0	.03	.03	1.79	.04	.05	
5/4/19	35	.23	.10	.59	.16	.29	
5/4/23	0	.03	.09	.68	.08	.11	

STATION	DEPTH	Ca	Mg	Al	K	Fe
2	0	13.5	19.8	18.5	6.8	15.4
2	45	13.1	16.4	19.3	5.4	15.5
3	0	11.6	15.6	17.0	6.3	14.2
3	40	6.9	17.7	22.0	6.3	17.5
5	0	17.3	18.0	9.3	4.1	7.6
5	40	10.6	25.0	8.4	6.3	8.3
6	0	9.7	14.4	5.0	4.1	6.7
6	63	16.1	15.6	9.8	4.1	7.8
7	0	14.3	26.2	20.2	6.6	10.7
7	66	9.5	17.7	8.4	5.5	8.9
8	0	9.5	19.3		4.6	7.6
8	90	12.1	24.8		4.8	13.5
9	0	13.6	44.0		7.7	2.9
9	77	11.1	17.7	15.2	4.2	15.4
10	0	7.9	10.4		1.8	2.6
10	60	35.6	117.7		22.8	10.0
10	110	3.5	21.0	34.3	6.6	27.2
11	0	6.9	19.3		4.6	5.0
11	24	9.5	25.0	22.0	7.2	20.1
14	0	8.3	17.3		2.8	1.0
18	0	10.0	14.8		4.6	3.0
19	0	8.2	18.1		3.9	1.7
21	0	9.0	11.8		2.1	6.3
21	90	3.5	35.4	28.6	4.8	13.7
22	0	4.3	6.0		1.1	2.6
22	53	6.7	18.6	11.7	4.0	10.7
23	0	9.0	20.7		3.8	4.3
23	40	11.6	32.5		7.2	4.6
24	0	8.5	11.8		2.1	4.3
24	60	8.8	11.4		3.0	10.5
25	0	5.9	14.8	16.6	3.8	14.9
25	45	7.4	23.6	27.3	5.5	20.1
26	0	45.0	38.9	188.6	25.1	129.0
26	17	70.5	50.4	252.3	31.0	157.7
5/2/1	0	150.6	504.	3386.	288.	4550.
5/2/2	0	71.6	359.	2130.	204.	1240.
5/2/3	0	33.5	180.	1071.	112.	725.
5/2/4	0	49.	191.	1695.	134.	1102.
5/2/5	0	34.	136.	1400.	113.	894.
5/2/6	0	55.	183.	1480.	102.	1044.
5/2/7	0	36.5	201.	1180.	142.	820.
5/2/8	0	36.5	162.	1370.	144.	967.
5/2/9	0	55.	95.	1242.	77.	757.
5/2/10	0	61.	123.	2040.	142.	1297.
5/2/11	0	55.	113.	1290.	110.	683.
5/2/12	0	45.	125.	1890.	134.	1163.
5/2/14	0	61.	305.	2350.	147.	1474.
5/2/16	0	55.	127.	1770.	132.	1200.
5/2/18	0	49.	126.	1918.	141.	1231.
5/2/20	0	42.	144.	1870.	148.	1194.

STATION	DEPTH	Ca	Mg	Al	K	Fe
5/2/21	0	49.	144.	1736.	136.	1036.
5/2/22	0	55.	145.	1740.	160.	1210.
5/2/23	0	67.	211.	1795.	184.	1173.
5/2/24	0	79.	217.	1635.	158.	1138.
5/2/25	0	33.	217.	1525.	154.	1004.
5/2/26	0	21.	128.	1235.	103.	778.
5/2/27	0	21.	121.	976.	93.	629.
5/2/28	0	49.	140.	1145.	96.	790.
5/2/29	0	44.	124.	985.	73.	554.
5/2/30	0	61.	170.	1620.	139.	1020.
5/2/31	0	61.	143.	1460.	126.	954.
5/2/32	0	42.	123.	1400.	113.	960.
5/2/33	0	116.	353.	2700.	262.	1773.
5/2/34	0	52.	143.	1800.	140.	1080.
5/2/35	0	55.	128.	2090.	142.	1287.
5/2/37	0	79.	170.	2990.	188.	2094.
5/2/39	0	104.	183.	3180.	199.	2194.
5/2/40	0	79.	173.	3210.	184.	2330.
5/2/41	0	85.	168.	2440.	171.	1737.
5/2/42	0	181.	256.	1080.	107.	715.
5/2/43	0	43.	122.	393.	64.	262.
5/2/44	0	43.	125.	340.	61.	231.
5/2/46	0		345.	35.	86.7	28.
5/2/47	0		32.5		6.4	5.
5/2/48	0		39.		8.3	8.
5/2/49	0	202.5	644.	1360.	285.6	737.
5/2/50	0	101.	96.5	127.5	46.4	265.
5/2/51	0	14.2	61.5	153.	13.2	102.
5/2/52	0	30.6	84.	26.	17.3	21.
5/2/53	0	23.6	81.		13.2	18.
5/2/54	0		61.5		13.2	8.
5/2/55	0	17.7	45.5		.8	21.
5/2/56	0	94.5	126.8	510.5	58.7	341.
5/2/57	0	44.	108.	204.	44.6	141.
5/2/58	0	9.2	47.3	23.6	6.2	33.
5/2/59	0	11.7	59.1		10.1	19.
5/2/60	0	20.1	67.7	65.5	12.	60.
5/2/61	0	17.7	41.4	23.6	6.4	28.
5/2/62	0	185.	263.	1119.	116.6	759.
5/2/64	0	159.5	342.	1855.	134.7	1352.
5/2/66	0	66.5	204.	1100.	96.7	768.
5/2/68	0	138.	227.	1264.	123.5	885.
5/2/70	0	219.7	616.5	3490.	275.9	2543.
5/2/71	0	21.	79.5	956.5	39.	174.
5/2/73	0	1478.	1560.	16807.	723.5	10525.
5/2/83	0	436.8	557.	2268.	327.	1569.
5/2/84	0	459.	709.	2691.	402.	2024.
5/2/85	0	486.	211.	2304.	393.	1780.
5/2/86	0	114.	699.	886.	99.	599.
5/2/87	0	105.2	114.	484.	38.	364.

STATION	DEPTH	Ca	Mg	Al	K	Fe
5/2/88	0	72.3	136.	627.	72.	464.
5/2/89	0	81.	138.	650.	74.	411.
5/2/90	0	282.	303.	1715.	120.	972.
5/2/91	0	206.4	486.	2050.	262.	1343.
5/2/92	0	281.	402.	935.	195.	631.
5/2/93	0	20.1	413.	50.	15.7	51.
5/2/94	0	329.	380.	878.	187.	606.
5/2/95	0	268.	611.	805.	175.	578.
5/2/96	0	991.	673.	1755.	290.	1144.
5/2/97	0	705.	515.	2255.	174.	1492.
5/2/98	0	1316.	732.	3353.	786.	2395.
5/2/99	0	297.	468.	759.	210.	463.
5/2/99B	0	194.	174.	613.	92.	420.
5/2/100	0	177.	242.	632.	126.	388.
5/2/100B	0	407.	680.	2063.	247.	1335.
5/2/101	0	92.	168.	386.	76.	268.
5/2/101B	0	296.	417.	1768.	239.	1125.
5/2/102	0	84.	390.	400.	92.	279.
5/2/102B	0	864.	440.	2172.	237.	1595.
5/2/103	0	174.	152.	382.	70.	265.
5/2/103B	0	236.	473.	854.	157.	536.
5/2/104	0	161.	116.	582.	59.	369.
5/2/104B	0	219.	229.	1046.	103.	637.
5/2/105	0	131.	97.	500.	52.	330.
5/2/105B	0	295.	145.	954.	78.	621.
5/2/106	0	114.	77.7	305.	45.	218.
5/2/106B	0	153.	91.	668.	57.	432.
5/2/107	0	134.	120.	465.	59.	316.
5/2/108	0	137.	101.	465.	51.	298.
5/2/109	0	123.	123.	433.	58.	296.
5/2/110	0	111.	98.	455.	51.	294.
5/2/111	0	120.	56.	340.	46.	234.
5/2/112	0	634.	817.	285.	496.	1500.
5/1/113	0	409.	203.	1200.	169.	845.
5/2/114	0	96.7	40.9	288.	57.	199.
5/2/115	0	336.	150.	1053.	119.	670.
5/2/116	0	267.	89.	667.	96.	464.
5/2/117	0	214.	52.	517.	81.	353.
5/2/118	0	491.	144.	1418.	123.	895.
5/2/119	0	221.	91.5	731.	79.	428.
5/2/120	0	89.	102.	531.	64.	347.
5/2/121	0	42.5	117.	260.	77.	182.
5/2/122	0	85.	157.	1620.	94.	1125.
5/2/123	0	77.3	112.	873.	108.	570.
5/2/124A	0	158.	84.	408.	54.	278.
5/2/124B	0	87.	42.	308.	69.	218.
5/2/124C	0	97.	58.	333.	74.	255.
5/3/2001	0	1810.	269.	2765.	169.	1922.
5/3/2002	0	1258.	308.	2472.	203.	1663.
5/3/2003	0	673.	282.	1758.	135.	1204.

STATION	DEPTH	Ca	Mg	Al	K	Fe
5/3/2004	0	348.	160.	1160.	91.	783.
5/3/2005	0	382.	209.	1392.	97.	900.
5/3/2006	0	522.	267.	758.	115.	1169.
5/3/2007	0	235.	204.	1167.	97.	725.
5/3/2008	0	629.	280.	1908.	128.	1269.
5/3/2009	0	173.	176.	1067.	93.	608.
5/3/2010	0	394.	190.	1108.	77.	792.
5/3/2011	0	421.	170.	1500.	73.	980.
5/3/2012	0	420.	180.	1358.	84.	858.
5/3/2013	0	615.	208.	1958.	114.	1297.
5/3/2014	0	593.	210.	1817.	97.	1133.
5/3/2015						
5/3/2016						
5/3/2017	0	18.5	111.	675.		439.
5/3/2018	0	102.	108.	800.	61.	526.
5/3/2019	0	184.	108.	542.	57.	476.
5/3/2020	0	271.	188.	1233.	96.	810.
5/3/2021	0	558.	185.	1667.	106.	1100.
5/3/2022						
5/3/2023	0	1213.	318.	3275.	228.	2235.
5/3/2024						
5/3/2025	0	123.	206.	1085.	83.	719.
5/3/2027	0	174.	227.	1245.	89.	852.
5/3/2028	0	101.	188.	1040.	85.	734.
5/3/2029	0	111.	157.	796.	65.	548.
5/3/2030	0	1077.	724.	3983.	293.	2757.
5/3/2031	0	455.	537.	3075.	206.	2067.
5/3/2032	0	173.	1608.	900.	74.	598.
5/3/2033	0	388.	371.	1952.	163.	1382.
5/3/2036	0	2162.	2263.	29783.	392.	26167.
5/3/2037	0	4096.	4500.	50533.	1745.	39667.
5/3/2038	0	4650.	4460.	60667.	1957.	43866.
5/3/2039	0	2244.	3413.	45900.	1543.	37033.
5/3/2042	0	4651.	3478.	47825.	1662.	43963.
5/3/2043	0	4409.	7850.	23175.	794.	18025.
5/3/2044	0	1941.	2558.	44200.	1342.	37100.
5/3/2045	0					
5/3/2047	0	395.	605.		245.	7096.
5/3/2048	0	255.	1693.	8717.	772.	6049.
5/3/2049	0	28837.	9650.	112650.	5009.	67535.
5/3/2050	0	15.8	51.	95.	16.	80.
5/3/2051	0	48.	229.	2335.	84.	1952.
5/3/2052	0	101.2	668.	10885.	402.	9130.
5/3/2053	0	40.	211.	2020.	86.	1393.
5/3/2054	0	17.1	195.	2593.	92.	1843.
5/3/2055	0	52.1	265.	2964.	112.	2165.
5/3/2056	0	18.	129.	571.	47.	395.
5/3/2057	0	10.0	46.	26.	9.	38.
5/3/205A	0	18.	62.	295.	43.	204.
5/3/2061	0	11.1	97.	85.	18.	84.

STATION	DEPTH	Ca	Mg	Al	K	Fe
5/3/2062	0	8.8	68.	65.	11.	48.
5/3/2063	0	8.	41.	49.	9.	54.
5/3/2064	0	22.	52.	85.	9.	78.
5/3/2065	0	45.	41.	3.	6.	11.
5/3/2066	0	31.	100.	3.	21.	19.
5/3/2067	0	16.	78.	3.	11.	42.
5/3/2068	0	53.	118.	320.	44.	215.
5/3/2069	0	58.	88.	290.	35.	213.
5/3/2070	0	43.	141.	460.	69.	282.
5/3/2071	0	40.	134.	505.	61.	379.
5/3/2072	0	13.	49.	3.	6.	7.
5/3/2073	0	22.	68.	3.	9.	18.
5/3/2074	0	3.	29.	163.	33.	125.
5/3/2075	0	19.	39.		6.	17.
5/3/2076	0	8.	59.	55.	11.	55.
5/3/072A	0	5.	26.		4.	7.
5/3/073A	0	4.	46.	49.	9.	52.
5/3/074A	0	23.	66.	175.	33.	116.
5/3/075A	0	10.	80.	49.	14.	45.
5/3/076A	0	38.	65.	3.	9.	18.
5/3/071C	0	46.	119.	450.	51.	311.
5/3/2077	0	28.	93.	322.	44.	236.
5/3/077A	0	104.	119.	426.	57.	308.
5/3/2078	0	14.	26.		4.	8.
5/3/2079	0	7.	26.	26.	4.	37.
5/3/2080	0	5.	26.	49.	4.	45.
5/4/1	0	28.	72.	120.	14.	86.
5/4/1	43	23.	72.	85.	11.	59.
5/4/2	0	6.	23.	20.	4.	29.
5/4/2	60				7.4	13.
5/4/3	0	23.	88.		7.8	13.
5/4/3	60	32.	62.		11.	13.
5/4/4	0	35.	39.		14.	16.
5/4/4	60	23.	110.		7.5	13.
5/4/5	0	35.	42.	67.	13.	57.
5/4/5	40	3.	80.	175.	20.	121.
5/4/6	0	77.	139.	260.	62.	177.
5/4/6	25	178.	262.	730.	87.	
5/4/7	0	18.	49.	55.	7.	45.
5/4/7	40	19.	60.	84.	9.	56.
5/4/8	0	17.	65.	49.	9.	42.
5/4/8	44	19.	75.	84.	9.	81.
5/4/9	0	18.	10.	7.	1.	12.
5/4/9	40	14.	33.	10.	4.	18.
5/4/10	0	20.	43.	10.	6.	13.
5/4/10	70	23.	39.	26.	6.	29.
5/4/11	0	20.	60.	60.	9.	49.
5/4/11	40	30.	91.	95.	16.	75.
5/4/12	0	5.	16.	14.	2.	12.
5/4/12	70	92.	119.	170.	41.	126.

STATION	DEPTH	Ca	Mg	Al	K	Fe
5/4/13	0	13.	23.	30.	10.	21.
5/4/13	73	19.	45.	20.	6.	30.
5/4/14	0	8.	12.	14.	1.8	12.
5/4/14	69	21.	34.	20.	4.	19.
5/4/15	0	11.	21.	9.	2.3	7.
5/4/15	105	21.	81.	85.	14.3	66.
5/4/16	0	6.	16.	5.	7.	6.
5/4/16	40	23.	55.	10.	6.	15.
5/4/17	0	6.	10.	3.	1.	4.
5/4/17	45	21.	65.	15.	12.7	24.
5/4/18	0	7.	8.	2.	1.3	3.
5/4/18	110	18.	46.	25.	5.8	38.
5/4/19	0	6.	18.	5.	1.8	18.
5/4/19	35	25.	60.	10.	7.5	12.
5/4/23	0	7.	12.		2.5	1.

Table XII

Ratios of the element/Al relation in the suspended matter. All data.

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al	Zn/Al
2	0	20.00	.54	10.81	8.65	5.95	
2	45	23.32	.52	15.03	5.70	4.66	
3	0	27.06	3.53	23.53	15.29	7.65	77.06
3	40	33.64	.91	23.64	6.82	12.73	
5	0	108.60	12.90	37.63	51.61	16.13	
5	40	86.90	17.86	51.19	17.86	26.19	50.00
6	0	136.00	26.00	76.00	28.00	14.00	230.00
6	63	63.27	17.35	39.80	18.37	8.16	
7	0	18.81	3.47	14.85	13.37	2.48	
7	66	28.57	11.90	41.67	22.62	13.10	
8	0						
8	90						
9	0						
9	77	27.63	6.58	45.39	11.84	55.92	
10	0						
10	60						
10	110	14.58	.87	13.12	5.25	6.71	23.62
11	0						
11	24	56.82	5.91	18.18	5.00	9.09	
14	0						
18	0						
19	0						
21	0						
21	90	32.17	5.59	18.53	136.36	6.64	
22	0						
22	53	47.01	7.69	19.66	11.97	5.13	
23	0						
23	40						
24	0						
24	60						
25	0	28.92	3.61	30.12	11.45	10.84	
25	45	39.19	5.13	37.36	6.96	6.23	
26	0	4.77	2.12	7.79	2.23	3.34	
26	17	5.07	.44	4.91	2.42	2.46	
5/2/1	0	.65	.07	.51	.45	.89	3.14
5/2/2	0	1.78	.14	.80	.59	1.02	
5/2/3	0	2.10	.22	.92	.57	.61	
5/2/4	0	1.46	.06	.95	.57	.91	
5/2/5	0	2.03	.26	.89	.51	.79	
5/2/6	0	2.23	.28	1.72	.53	.37	
5/2/7	0	3.34	.79	5.66	.92	1.20	
5/2/8	0	3.21	.36	3.21	.82	.89	
5/2/9	0	2.25	.25	1.66	.71	.83	
5/2/10	0	1.78	.23	1.40	.46	.57	
5/2/11	0	2.47	.50	1.82	.84	.98	
5/2/12	0	2.36	.33	1.64	.89	1.02	
5/2/14	0	1.74	.25	1.32	.46	.55	
5/2/16	0	2.50	.14	1.36	.51	.67	
5/2/18	0	2.13	.22	1.66	.59	1.51	
5/2/20	0	2.30	.39	1.65	.76	.67	

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al	Zn/Al
5/2/21	0	2.03	.60	2.35	.82	1.13	
5/2/22	0	2.69	.26	1.45	.74	.72	5.66
5/2/23	0	2.03	.67	1.34	.92	.62	
5/2/24	0	2.92	.50	2.02	.65	.62	
5/2/25	0	2.26	.32	2.13	.89	.92	
5/2/26	0	2.28	.30	1.23	1.17	.63	
5/2/27	0	2.83	.35	1.73	1.20	.67	
5/2/28	0	2.54	.21	1.58	.88	.52	
5/2/29	0	3.82	.46	2.44	1.03	.46	
5/2/30	0	3.60	.54	2.85	1.51	.73	
5/2/31	0	2.07	.34	3.24	3.23	.54	
5/2/32	0	3.11	.36	4.20	1.04	.51	
5/2/33	0	1.50	.88	3.77	3.06	.93	
5/2/34	0	2.63	.18	2.76	2.77	.69	
5/2/35	0	2.08	.12	2.34	1.82	.85	
5/2/37	0	1.72	.07	1.68	.48	.47	
5/2/39	0	1.62	.11	1.75	.82	.40	
5/2/40	0	1.67	.21	1.83	1.05	.69	
5/2/41	0	1.44	.12	1.32	.98	.48	
5/2/42	0	1.05	.20	2.11	1.79	1.32	
5/2/43	0	2.72	.38	9.82	4.96	1.37	
5/2/44	0	1.97	.79	4.32	4.76	2.15	
5/2/46	0	14.86	7.43	6.00	14.86	10.00	
5/2/47	0						
5/2/48	0						
5/2/49	0	.95	.05	.71	1.34	1.21	
5/2/50	0	7.22	1.33	6.59	8.47	8.16	
5/2/51	0	3.20	2.88		2.42	1.18	
5/2/52	0	13.08	1.54	15.00	9.62	10.77	
5/2/53	0						
5/2/54	0						
5/2/55	0						
5/2/56	0	1.12	.14	1.98	1.29	1.86	
5/2/57	0	2.60	.25	3.38	1.52	1.72	
5/2/58	0	27.12	2.12	22.46	5.51	2.12	
5/2/59	0						
5/2/60	0	11.91	.61	13.13	6.87	5.19	
5/2/61	0	27.97	42.37	55.51	13.56	3.39	
5/2/62	0	1.39	.12	1.39	1.05	1.61	
5/2/64	0	1.15	.10	.86	1.04	1.59	4.51
5/2/66	0	1.46	.20	2.01	1.15	1.67	
5/2/68	0	1.13	.09	1.14	1.19	1.94	6.74
5/2/70	0	1.27	.03	.74	.75	1.20	3.27
5/2/71	0	.55	.17	.96	1.46	3.73	
5/2/73	0	.40	.02	.43	.36	.51	1.50
5/2/83	0	.83	.04	.67	.92	1.59	3.30
5/2/84	0	.98	.03	.81	.77	1.41	3.06
5/2/85	0	1.09	.10	1.05	.97	1.55	5.16
5/2/86	0	1.06	.06	1.70	.87	1.49	12.79
5/2/87	0	1.57	.29	1.96	3.64		20.21

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al	Zn/Al
5/2/88	0	1.52	1.32	2.42	2.33	2.46	10.32
5/2/89	0	1.60	.42	1.65	1.11	1.78	15.08
5/2/90	0	.69	.08	.75	.76	.71	3.40
5/2/91	0	1.60	.10	.68	.66	1.08	
5/2/92	0	1.57	.05	.82	1.63	1.83	
5/2/93	0	11.00	2.80	9.20	4.60	3.00	
5/2/94	0	1.65	.10	1.08	1.57	2.26	4.93
5/2/95	0	1.35	.07	1.01	1.07	1.74	8.39
5/2/96	0	1.28	.09	.49	.89	1.28	3.11
5/2/97	0	1.01	.14	.66	.58	1.27	3.30
5/2/98	0	.52	.06	.73	.78		5.54
5/2/99	0	1.07	.20	.95	1.84	6.51	13.32
5/2/99B	0	1.86	.18	2.15	.86	1.62	
5/2/100	0	2.56	.09	1.87	.84	1.47	
5/2/100B	0	1.07	.03	1.22	.70	1.47	8.98
5/2/101	0	1.71	.21	2.77	1.42	2.15	
5/2/101B	0	.96	.04	1.10	.58	1.23	3.58
5/2/102	0	1.57	.42	2.83	1.32	2.00	
5/2/102B	0	.97	.04	.97	.64	1.22	4.29
5/2/103	0	2.30	.31	4.40	1.78	1.78	
5/2/103B	0	.93	.25	1.72	1.25	1.43	
5/2/104	0	1.89	.19	2.85	1.41	1.62	19.79
5/2/104B	0	1.28	.14	1.86	1.00	1.35	5.29
5/2/105	0	2.26	.50	4.72	2.06	1.60	
5/2/105B	0	1.30	.10	1.74	.49	1.84	8.64
5/2/106	0	3.02	.72	4.36	2.75	2.13	
5/2/106B	0	1.78	.16	3.08	1.24	1.48	
5/2/107	0	1.81	1.12	7.83	1.44	2.19	
5/2/108	0	1.87	.15	4.00	1.53	1.46	
5/2/109	0	4.16	.62	8.87	4.30	6.10	
5/2/110	0	1.85	.11	2.79	2.00	2.15	
5/2/111	0	3.32	.24	5.50	3.18	2.82	
5/2/112	0	9.93	.95	8.63	6.39	13.58	
5/1/113	0	1.69	.17	2.64	1.58	1.30	
5/2/114	0	5.94	.69	9.06	9.69	5.03	
5/2/115	0	1.88	.28	3.74	1.85	1.75	
5/2/116	0	3.10	.24	4.11	3.82	1.92	
5/2/117	0	1.97	.25	7.89	2.32	2.67	
5/2/118	0	2.02	.06	3.81	1.13	1.99	
5/2/119	0	2.19	.22	3.24	1.45	1.04	
5/2/120	0	2.07	.36	3.18	2.05	1.45	
5/2/121	0	3.73	.58	14.62	7.12	2.15	
5/2/122	0	2.56	.06	2.73	.70	.81	
5/2/123	0	5.52	.16	4.16	4.65	3.09	
5/2/124A	0	2.50	.39	12.40	7.43	3.50	
5/2/124B	0	3.15	.58	9.84	3.86	3.70	
5/2/124C	0	3.21	.54	10.78		4.50	
5/3/2001	0	1.07	.04	1.06	.89	1.06	3.52
5/3/2002	0	2.18	.11	1.89	2.55	1.64	5.36
5/3/2003	0	2.00	.07	1.33	1.34	1.88	7.03

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al	Zn/Al
5/3/2004	0	2.59	.20	2.64	1.54	1.66	7.94
5/3/2005	0	2.36	.15	2.37	1.59	1.84	6.70
5/3/2006	0	3.47	.22	3.19	2.48	2.85	10.09
5/3/2007	0	1.71	.16	3.31	2.51	1.46	
5/3/2008	0	1.82	.13	2.31	1.16	1.15	
5/3/2009	0	2.67	.29	4.57	1.30	1.45	
5/3/2010	0	2.30	.12	1.88	1.46	1.20	
5/3/2011	0	1.97	.08	1.85	1.25	1.20	
5/3/2012	0	1.27	.15	1.51	1.27	.68	
5/3/2013	0	1.08	.09	1.32	.97	.83	
5/3/2014	0	1.76	.07	2.05	1.07	.91	
5/3/2015							
5/3/2016							
5/3/2017	0	.40	.06	.67	.43	.83	
5/3/2018	0	2.05	.25	5.99	1.52	.94	
5/3/2019	0	2.95	.35	5.13	2.71	3.36	
5/3/2020	0	2.08	.17	1.39	1.65	1.87	
5/3/2021	0	1.54	.08	1.47	1.40	1.54	
5/3/2022							
5/3/2023	0	1.41	.54	3.64	1.74	1.28	
5/3/2024							
5/3/2025	0	.91	.17	2.41	.87	1.22	
5/3/2027	0	.90	.17	2.35	1.27	1.36	
5/3/2028	0	1.00	.21	2.45	1.44	1.84	
5/3/2029	0	.92	.49	2.55	1.34	1.78	
5/3/2030	0	.74	.07	1.37	1.12	1.23	
5/3/2031	0	.88	.06	1.07	.75	.98	
5/3/2032	0	1.00	.36	3.98	1.41	1.60	
5/3/2033	0	.92	.20	1.17	1.07	1.19	
5/3/2036	0	1.14	.02	.45	.29	.39	1.84
5/3/2037	0	1.10	.01	.44	.25	.33	1.95
5/3/2038	0	.98	.01	.26	.18	.32	1.62
5/3/2039	0	1.12	.02	.35	.22	.32	1.89
5/3/2042	0	1.22	.01	.41	.25	.36	2.10
5/3/2043	0	1.43	.04	.58	.31	.32	3.28
5/3/2044	0	1.22	.01	.35	.17	.27	1.67
5/3/2045	0						
5/3/2047	0						
5/3/2048	0	1.17	.08	.61	.43	.41	3.12
5/3/2049	0	1.00	.01	.46	.10	.61	1.76
5/3/2050	0	5.68	3.58	113.05	5.58	8.11	
5/3/2051	0	1.38	.05	.85	.70	.67	2.50
5/3/2052	0	.89	.02	.33	.20	.25	1.66
5/3/2053	0	1.25	.13	.89	.47	.68	2.74
5/3/2054	0	1.13	.09	3.39	.90	.80	2.61
5/3/2055	0	1.58	.08	1.29	.48	.33	2.10
5/3/2056	0	2.22	.40	1.98	1.12	.56	6.81
5/3/2057	0	12.31	1.92	7.69	4.62	5.00	
5/3/205A	0	4.58	.88	9.29	1.93	2.64	
5/3/2061	0	7.29	.82	6.94	3.41	3.41	

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al	Zn/Al
5/3/2062	0	4.46	.46	3.85	.62	1.38	
5/3/2063	0	3.06	.61	5.10	1.84	3.47	
5/3/2064	0	5.88	1.18	6.35	1.88	3.41	
5/3/2065	0	120.00	10.00	140.00	126.67	13.33	
5/3/2066	0	236.67	16.67	140.00	43.33	30.00	
5/3/2067	0	73.33	33.33	520.00	3.33	30.00	
5/3/2068	0	3.34	.41	2.97	2.19	1.25	
5/3/2069	0	3.21	.59	3.28	2.10	1.93	
5/3/2070	0	2.63	.28	2.98	1.11	1.07	
5/3/2071	0	2.63	.24	2.10	.85	.91	
5/3/2072	0	26.67	6.67	70.00	156.67	60.00	
5/3/2073	0	143.33	16.67	140.00	3.33	33.33	
5/3/2074	0	4.60	1.04	9.57	3.56	2.02	
5/3/2075	0						
5/3/2076	0	14.55	.36	4.73		1.82	
5/3/072A	0						
5/3/073A	0	1.63	1.43	3.27		2.04	
5/3/074A	0	3.14	2.17	5.89	6.51	.97	
5/3/075A	0	1.63	1.63	31.43	3.06	2.24	
5/3/076A	0	26.67	13.33	180.00	46.67	23.33	
5/3/071C	0	1.47	.31	6.16	2.62	1.04	
5/3/2077	0	1.43	.28	3.20	1.61	.93	
5/3/077A	0	2.21	.40	7.72	2.77	1.24	
5/3/2078	0						
5/3/2079	0	1.92	.77	20.77	4.23	1.15	
5/3/2080	0	1.63	.61	9.80	2.65	2.24	
5/4/1	0	3.25	1.08	68.08	3.00	3.17	
5/4/1	43	1.88	.59	13.41	1.18	2.00	
5/4/2	0	4.00	3.50	45.50	7.00	5.50	
5/4/2	60						
5/4/3	0						
5/4/3	60						
5/4/4	0						
5/4/4	60						
5/4/5	0	3.58	.90	19.10	3.28	2.24	
5/4/5	40	1.77	.57	4.29	1.43	2.40	
5/4/6	0	2.73	1.08	6.88	8.31	2.19	
5/4/6	25	1.40	.34	3.36	1.93	1.53	
5/4/7	0	1.64	.91	15.27	.91	6.00	
5/4/7	40	1.90	.48	8.93	1.67	2.02	
5/4/8	0	1.84	2.45	11.02	2.45	2.65	
5/4/8	44	2.86	.48	7.14	2.74	7.98	
5/4/9	0	11.43	2.86	80.00	10.00	15.71	
5/4/9	40	9.00	3.00	48.00	10.00	17.00	
5/4/10	0	31.00	30.00	737.00	14.00	38.00	
5/4/10	70	11.92	2.69	94.62	11.15	9.62	
5/4/11	0	5.17	14.67	259.67	3.83	2.83	
5/4/11	40	3.26	4.95	213.05	4.21	4.00	
5/4/12	0	3.57	.71	36.43	4.29	5.00	
5/4/12	70	1.94	.94	11.94	9.24	4.71	

STATION	DEPTH	Cu/Al	Cd/Al	Pb/Al	Ni/Al	Cr/Al
5/4/13	0	2.67	1.33	5.33	7.00	9.33
5/4/13	73	32.50	12.00	138.00	24.00	16.50
5/4/14	0	4.29	1.43	22.86	4.29	15.00
5/4/14	69	4.50	2.00	29.50	13.50	6.00
5/4/15	0	8.89	4.44	17.78	6.67	3.33
5/4/15	105	1.88	.94	56.71	5.65	16.24
5/4/16	0	6.00	8.00	50.00	42.00	20.00
5/4/16	40	58.00	25.00	509.00	19.00	16.00
5/4/17	0	26.67	53.33	923.33	23.33	16.67
5/4/17	45	1.33	3.33	116.67	16.00	8.00
5/4/18	0	20.00	10.00	40.00	20.00	25.00
5/4/18	110	3.60	2.40	84.80	6.40	8.00
5/4/19	0	6.00	6.00	358.00	8.00	10.00
5/4/19	35	23.00	10.00	59.00	16.00	29.00
5/4/23	0					

STATION	DEPTH	Fe/Al	Si/Al	Mg/Al	Ca/Al	K/Al	Mn/Al
2	0	.83	6.34	1.07	.73	.37	
2	45	.80	6.35	.85	.68	.28	
3	0	.84	6.37	.92	.68	.37	
3	40	.80	5.55	.80	.31	.29	
5	0	.82	10.2	1.94	1.86	.44	
5	40	.99	10.28	2.98	1.26	.75	
6	0	1.34		2.88	1.94	.82	
6	63	.80	7.72	1.59	1.64	.42	
7	0	.53	7.19	1.30	.71	.33	
7	66	1.06	14.71	2.11	1.13	.65	
8	0						
8	90						
9	0						
9	77	1.01	5.19	1.16	.73	.28	
10	0						
10	60						
10	110	.79		.61	.10	.19	
11	0						
11	24	.91	3.93	1.14	.43	.33	
14	0						
18	0						
19	0						
21	0						
21	90	.48		1.24	.12	.17	
22	0						
22	53	.91		1.59	.57	.34	
23	0						
23	40						
24	0						
24	60						
25	0	.90		.89	.36	.23	
25	45	.74		.86	.27	.20	
26	0	.68	2.55	.21	.24	.13	16.87
26	17	.63	2.33	.20	.28	.12	18.02
5/2/1	0	1.34	3.	.15	.04	.09	25.25
5/2/2	0	.58	1.93	.17	.03	.10	23.46
5/2/3	0	.68	1.95	.17	.03	.10	33.10
5/2/4	0	.65	1.87	.11	.03	.08	38.65
5/2/5	0	.64	2.01	.10	.02	.08	42.81
5/2/6	0	.71	2.04	.12	.04	.07	41.18
5/2/7	0	.69	2.39	.17	.03	.12	44.07
5/2/8	0	.71	2.06	.12	.03	.11	47.46
5/2/9	0	.61	2.00	.08	.04	.06	35.82
5/2/10	0	.64	1.94	.06	.03	.07	21.57
5/2/11	0	.53	2.18	.09	.04	.09	20.15
5/2/12	0	.62	1.91	.07	.02	.07	22.73
5/2/14	0	.63	1.94	.13	.03	.06	31.48
5/2/16	0	.68	2.12	.07	.03	.07	29.25
5/2/18	0	.64	1.96	.07	.03	.07	24.70
5/2/20	0	.64	1.98	.08	.02	.08	27.28

STATION	DEPTH	Fe/Al	Si/Al	Mg/Al	Ca/Al	K/Al	Mn/Al
5/2/21	0	.60	1.96	.08	.03	.08	25.34
5/2/22	0	.70	2.13	.08	.03	.09	37.50
5/2/23	0	.65	2.06	.12	.04	.10	38.91
5/2/24	0	.70	2.06	.13	.05	.10	34.
5/2/25	0	.66	1.95	.14	.02	.10	35.
5/2/26	0	.63	2.23	.10	.02	.08	39.
5/2/27	0	.64	2.05	.12	.02	.10	43.
5/2/28	0	.69	2.08	.12	.04	.08	42.
5/2/29	0	.56	1.84	.13	.04	.07	43.
5/2/30	0	.63	2.14	.10	.04	.09	38.
5/2/31	0	.65	2.58	.10	.04	.09	36.
5/2/32	0	.69	2.05	.09	.03	.08	28.
5/2/33	0	.66	2.11	.13	.04	.10	15.
5/2/34	0	.60	1.90	.08	.03	.08	19.
5/2/35	0	.62	1.91	.06	.03	.07	21.
5/2/37	0	.70	2.03	.06	.03	.06	23.
5/2/39	0	.69	2.01	.06	.03	.06	27.
5/2/40	0	.73	1.98	.05	.02	.06	22.
5/2/41	0	.71	2.04	.07	.03	.07	20.
5/2/42	0	.66	2.52	.24	.17	.10	10.
5/2/43	0	.67	2.40	.31	.11	.16	11.
5/2/44	0	.68	2.43	.37	.13	.18	13.
5/2/46	0	.80	6.05	9.86		2.48	
5/2/47	0						
5/2/48	0						
5/2/49	0	.54	2.23	.47	.15	.21	10.
5/2/50	0	2.08	2.45	.76	.79	.36	11.
5/2/51	0	.67	3.37	.40	.09	.09	
5/2/52	0	.81	9.97	3.23	1.18	.67	
5/2/53	0						
5/2/54	0						
5/2/55	0						
5/2/56	0	.67	2.92	.25	.19	.11	12.
5/2/57	0	.69	3.31	.53	.22	.22	25.
5/2/58	0	1.40	9.97	2.00	.39	.26	
5/2/59	0						
5/2/60	0	.92	4.16	1.03	.31	.18	
5/2/61	0	1.19	6.38	1.75	.75	.27	
5/2/62	0	.68	2.50	.24	.17	.10	9.
5/2/64	0	.73	3.18	.18	.09	.07	14.
5/2/66	0	.70	2.28	.19	.06	.09	21.
5/2/68	0	.70	2.45	.18	.11	.10	10.
5/2/70	0	.73	3.24	.18	.06	.08	18.
5/2/71	0	.77	4.2	.08	.02	.04	28.
5/2/73	0	.69	2.79	.09	.09	.04	18.
5/2/83	0	.69	3.81	.25	.19	.14	7.
5/2/84	0	.75	4.01	.26	.17	.15	14.
5/2/85	0	.77	4.12	.09	.21	.17	15.
5/2/86	0	.68	2.21	.79	.13	.11	12.
5/2/87	0	.75	2.53	.24	.22	.08	102.

STATION	DEPTH	Fe/Al	Si/Al	Mg/Al	Ca/Al	K/Al	Mn/Al
5/2/88	0	.74	2.49	.22	.12	.11	14.
5/2/89	0	.63	2.31	.21	.12	.11	12.
5/2/90	0	.57		.18	.16	.07	13.
5/2/91	0	.66	3.39	.24	.10	.13	11.
5/2/92	0	.67	2.30	.43	.30	.21	14.
5/2/93	0	1.02	4.92	8.26	.40	.31	
5/2/94	0	.69	2.68	.43	.37	.21	18.
5/2/95	0	.72	2.74	.76	.33	.22	19.
5/2/96	0	.65	3.37	.38	.56	.17	17.
5/2/97	0	.66	2.85	.23	.31	.08	18.
5/2/98	0	.71	2.90	.22	.39	.23	14.
5/2/99	0	.61	2.40	.62	.39	.28	23.
5/2/99B	0	.69	2.62	.28	.32	.15	55.
5/2/100	0	.61	2.26	.38	.28	.20	22.
5/2/100B	0	.65	2.73	.33	.20	.12	16.
5/2/101	0	.69	3.19	.44	.24	.20	63.
5/2/101B	0	.64	2.29	.24	.17	.14	14.
5/2/102	0	.70	2.24	.98	.21	.23	72.
5/2/102B	0	.73	3.08	.20	.40	.11	19.
5/2/103	0	.69	2.13	.40	.46	.18	88.
5/2/103B	0	.63	2.12	.55	.28	.18	41.
5/2/104	0	.63	2.39	.20	.28	.10	70.
5/2/104B	0	.61	2.21	.22	.21	.10	44.
5/2/105	0	.66	2.40	.19	.26	.10	77.
5/2/105B	0	.65	2.31	.15	.31	.08	46.
5/2/106	0	.71	2.80	.25	.37	.15	85.
5/2/106B	0	.65	2.52	.14	.23	.09	63.
5/2/107	0	.68	2.32	.26	.29	.13	71.
5/2/108	0	.64	2.32	.22	.29	.11	62.
5/2/109	0	.68	2.27	.28	.28	.13	83.
5/2/110	0	.65	2.32	.22	.24	.11	64.
5/2/111	0	.69	3.05	.16	.35	.14	57.
5/2/112	0	5.26	1.59	2.87	2.22	1.74	14.
5/1/113	0	.70	2.94	.17	.34	.14	35.
5/2/114	0	.69	3.26	.14	.34	.20	66.
5/2/115	0	.64	2.83	.14	.32	.11	19.
5/2/116	0	.70	2.94	.13	.40	.14	46.
5/2/117	0	.68	3.04	.10	.41	.16	50.
5/2/118	0	.63	2.83	.10	.35	.09	29.
5/2/119	0	.59	2.94	.13	.30	.11	38.
5/2/120	0	.65	2.84	.19	.17	.12	48.
5/2/121	0	.70	2.66	.45	.16	.30	55.
5/2/122	0	.69	2.03	.10	.05	.06	16.
5/2/123	0	.65	1.98	.13	.09	.12	8.
5/2/124A	0	.68	3.27	.21	.39	.13	96.
5/2/124B	0	.71	3.95	.14	.28	.22	92.
5/2/124C	0	.77	3.75	.17	.29	.22	93.
5/3/2001	0	.70	3.29	.10	.65	.06	15.
5/3/2002	0	.67	2.40	.12	.51	.08	12.
5/3/2003	0	.68	2.32	.16	.38	.08	8.
5/3/2004	0	.67	2.20	.14	.30	.08	6.
5/3/2005	0	.65	2.25	.15	.27	.07	14.
5/3/2006	0	1.54	1.76	.35	.69	.15	34.
5/3/2007	0	.62	2.21	.17	.20	.08	14.
5/3/2008	0	.67	2.41	.15	.33	.07	16.
5/3/2009	0	.57	2.24	.16	.16	.09	11.
5/3/2010	0	.71	2.22	.17	.36	.07	12.
5/3/2011	0	.65	2.17	.11	.28	.05	13.
5/3/2012	0	.63	2.13	.13	.31	.06	14.
5/3/2013	0	.66	2.17	.11	.31	.06	10.
5/3/2014	0	.62	2.15	.12	.33	.05	11.

STATION	DEPTH	Fe/Al	Si/Al	Mg/Al	Ca/Al	K/Al	Mn/Al
5/3/2015							
5/3/2016							
5/3/2017	0	.65	2.33	.16	.03		14.
5/3/2018	0	.66	2.18	.13	.13	.08	14.
5/3/2019	0	.88	2.78	.20	.34	.11	22.
5/3/2020	0	.66	2.22	.15	.22	.08	14.
5/3/2021	0	.66	2.30	.11	.33	.06	15.
5/3/2022							
5/3/2023	0	.68	2.41	.10	.37	.07	22.
5/3/2024							
5/3/2025	0	.66	2.36	.19	.11	.08	14.
5/3/2027	0	.68	2.38	.18	.14	.07	12.
5/3/2028	0	.71	2.38	.18	.10	.08	13.
5/3/2029	0	.69	2.32	.20	.14	.08	11.
5/3/2030	0	.69	3.31	.18	.27	.07	13.
5/3/2031	0	.67	2.34	.17	.15	.07	13.
5/3/2032	0	.66	2.35	1.79	.19	.08	18.
5/3/2033	0	.71	2.49	.19	.20	.08	16.
5/3/2036	0	.88	3.17	.08	.07	.01	20.
5/3/2037	0	.78	2.57	.09	.08	.03	19.
5/3/2038	0	.72	2.41	.07	.08	.03	21.
5/3/2039	0	.81	2.47	.07	.05	.03	22.
5/3/2042	0	.92	3.26	.07	.10	.03	25.
5/3/2043	0	.78	2.46	.34	.19	.03	6.
5/3/2044	0	.84	2.82	.06	.04	.03	21.
5/3/2045	0						
5/3/2047	0						
5/3/2048	0	.69	2.38	.19	.03	.09	8.
5/3/2049	0	.60	2.75	.09	.26	.04	19.
5/3/2050	0	.84		.54	.17	.17	
5/3/2051	0	.84	2.89	.10	.02	.04	7.
5/3/2052	0	.84		.06	.01	.04	
5/3/2053	0	.69	1.67	.10	.02	.04	9.
5/3/2054	0	.71	1.93	.08	.01	.04	11.
5/3/2055	0	.73	2.14	.09	.02	.04	19.
5/3/2056	0	.69	1.86	.23	.03	.08	68.
5/3/2057	0	1.46	3.71	1.77	.38	.35	19.
5/3/205A	0	.69	21.64	.21	.06	.15	
5/3/2061	0	.99	9.12	1.14	.13	.21	
5/3/2062	0	.74	8.32	1.05	.14	.17	
5/3/2063	0	1.10	8.67	.84	.16	.18	
5/3/2064	0	.92	4.70	.61	.26	.11	
5/3/2065	0	3.67	30.82	13.67	15.00	2.00	
5/3/2066	0	6.33	33.67	33.33	10.33	7.00	
5/3/2067	0	14.00	273.5	26.00	5.33	3.67	
5/3/2068	0	.67	2.31	.37	.17	.14	14.
5/3/2069	0	.73	2.58	.30	.20	.12	14.
5/3/2070	0	.61	2.71	.31	.09	.15	12.
5/3/2071	0	.75	2.93	.27	.08	.12	11.
5/3/2072	0	2.33	30.46	16.33	4.33	2.00	
5/3/2073	0	6.00	33.0	22.67	7.33	3.00	
5/3/2074	0	.77	2.46	.18	.02	.20	32.
5/3/2075	0						
5/3/2076	0	1.00	5.46	1.07	.15	.20	
5/3/072A	0						
5/3/073A	0	1.06	5.72	.94	.08	.18	
5/3/074A	0	.66	2.14	.38	.13	.19	
5/3/075A	0	.92	5.73	1.63	.20	.29	
5/3/076A	0	6.00	81.67	21.67	12.67	3.00	
5/3/071C	0	.69	2.56	.26	.10	.11	12.
5/3/2077	0	.73	2.83	.29	.09	.14	11.
5/3/077A	0	.72	2.04	.28	.24	.13	34.
5/3/2078	0						

STATION	DEPTH	Fe/Al	Si/Al	Mg/Al	Ca/Al	K/Al	Mn/Al
5/3/2079	0	1.42	11.49	1.00	.27	.15	
5/3/2080	0	.92	8.19	.53	.10	.08	
5/4/1	0	.72		.60	.23	.12	
5/4/1	43	.69	3.29	.85	.27	.13	
5/4/2	0	1.45	7.07	1.15	.30	.20	
5/4/2	60						
5/4/3	0						
5/4/3	60						
5/4/4	0						
5/4/4	60						
5/4/5	0	.85	5.22	.63	.52	.19	
5/4/5	40	.69	4.00	.46	.02	.11	
5/4/6	0	.68	3.00	.53	.30	.24	23.
5/4/6	25			.36	.24	.12	
5/4/7	0	.82	4.73	.89	.33	.13	
5/4/7	40	.67	3.56	.71	.23	.11	
5/4/8	0	.86	3.88	1.33	.35	.18	
5/4/8	44	.96	3.58	.89	.23	.11	
5/4/9	0	1.71	37.71	1.43	2.57	.14	
5/4/9	40	1.80	14.17	3.30	1.40	.40	
5/4/10	0	1.30	13.75	4.30	2.00	.60	
5/4/10	70	1.12		1.50	.88	.23	
5/4/11	0	.82		1.00	.33	.15	
5/4/11	40	.79		.96	.32	.17	
5/4/12	0	.86		1.14	.36	.14	
5/4/12	70	.74	2.83	.70	.54	.24	47.
5/4/13	0	.70	3.26	.77	.43	.33	23.
5/4/13	73	1.50	18.76	2.25	.95	.30	
5/4/14	0	.86	4.13	.86	.57	.13	
5/4/14	69	.95	7.42	1.70	1.05	.20	
5/4/15	0	.78	10.08	2.33	1.22	.26	
5/4/15	105	.78	3.88	.95	.25	.17	
5/4/16	0	1.20	16.15	3.20	1.20	1.40	121.
5/4/16	40	1.50	18.17	5.50	2.30	.60	
5/4/17	0	1.33	17.86	3.33	2.00	.33	
5/4/17	45	1.60	13.46	4.33	1.40	.85	
5/4/18	0	1.50	23.82	4.00	3.50	.65	
5/4/18	110	1.52	9.38	1.84	.72	.23	
5/4/19	0	3.60	9.43	3.60	1.20	.36	
5/4/19	35	1.20	14.89	6.00	2.50	.75	
5/4/23	0		14.				

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