Ｘ　ＪＩＣＡの分析技術研修

X　JICAの分析技術研修

環境庁及び国際協力事業団の要請により実施したインドネシア環境管理センターC／P（カウンターパート）の有害物質分析技術研修の内容及びその結果の概要は，次のとおりであった。

1．研修員

研修員：Ms.Asiah（28才）

インドネシア国の環境管理庁(Environmental Impact Management Agency, BAPEDAL)の環境調査・研究機関である環境管理センター(Environmental Management Center, EMC)所属の研究員。部門は有害物質セクション（特に底質中の重金属）。

2．研修期間

平成7年8月1日～10月27日

3．研修内容

旭川（秋田市）と小坂川（小坂町）を対象に，河川水及び河川底質中のマンガン，鉄，ニッケル，銅，亜鉛，鉛，カドミウム濃度の実態把握調査を設定し，調査を行う過程で，以下の内容を研修課題として盛り込んだ。

1）調査の目的・目標の設定
2）調査計画（試料採取地点など）の作成
3）試料採取方法・運搬，保存条件，フィルドノート
4）微量分析を実施する上での留意点
5）試料の前処理方法
6）原子吸光分析法の精度及び信頼性
7）濃度計算方法
8）測定データの信頼性の評価
9）目的・目標の達成度の評価

4．研修結果

研修成果として平成7年10月20日に，環境保全課，秋田保健所及び㈶秋田県分析化学センターの職員に対して，旭川と小坂川を対象とした河川水及び河川底質中におけるマンガン，鉄，ニッケル，銅，亜鉛，鉛，カドミウム濃度の実態把握調査の結果を発表するとともに，レポートのかたちで実態把握調査の結果を取りまとめた。レポートには，以下の内容が重点的に盛り込まれている。

1）調査対象河川（旭川，小坂川）での試料採取地点とその意味づけ
2）試料採取方法及び保存条件，フィルド状況
3）試料の前処理方法
4）原子吸光分析法の精度及び信頼性（繰り返し分析，添加回収率の測定，標準試料によるチェク）
5）測定データのとらえ方

5．研修の評価

研修の結果，1)試料採取方法及び保存条件，フィルド状況，2)試料の前処理方法，3)原子吸光分析法の精度及び信頼性（繰り返し分析，添加回収率の測定，標準試料によるチェク）については，技術レベルが相当程度向上し，インドネシアへ帰国後に行う底質中の重金属分析に対しては，分析の精度・信頼性は十分なものと考えられる。しかし，1)調査の目的・目標の設定，2)調査計画（試料採取地点等）の作成，3)測定データのとらえ方（測定データの評価）については，今後の課題と考えられ，これらは綿密に計画された調査を数多く経験する過程で習得されていくものと考えられる。

Technical Training Report

Determination of Elements (Mn, Fe, Ni, Zn, Cu, Pb, and Cd) in River Water and River Sediment Using by Atomic Absorption Spectrometer

by ASIAH

TechnicalTraining Term; 1/Aug.~27/Oct./'95

Training Staff;

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INTRODUCTION

In order to protect people's health, pollutants which are toxic to people, animals and plants have to be identified immediately when they are discharge into the air, rivers or cultivation lands from factories and/ or public bodies to provide early warming to people and to take necessary measures immediately. Pollution source comes from secondary process of industry that uses hazardous and toxic substances. Industries possessing high potential to generate hazardous and toxic waste, such as pulp and paper industry, chemical industry, paint, plywood, oil refinery, etc.

Environmental survey by analysis of water and sediment sample to evaluate the water quality in the river. In this case, especially survey of general elements in river water and river sediment. Main two places in this country were selected and the rivers flowing through the cities are focused.

The purpose of this study/training are to determination of elements concentration in river water and river sediment using by Atomic Absorption Spectrometer. The term of this study/training beginning from 1 August 1995 to 27 October 1995.

EXPERIMENTAL

SAMPLING LOCATION

Two places of sampling location are AKITA City (Asahi River) and KOSAKA Town (Kosaka River). Location of sampling points in Asahi River were selected (Fig.1) i.e; Asahimata is sources point (up stream), Matsubara Br., Soegawa Br., are a paddy field areas; Asahikawa Br. and Nicyome Br. are a people's living areas; Asahi Br., Sinkawa Br., Omono Gate, Katsuhira Br., and Minato-ohashi Br.(down stream) are an industrial areas. Even though location of sampling points in Kosaka River (Fig.2), i.e : Hachirouyachi is sources point (up stream), Ichinotame Br., Yamazaki Br., Zinbei Br., and Onari Br.(down stream) are a paddy field areas and people's living areas, but before Yamazaki Br.(about 1 km before) there were any industrial waste and domestic waste, that drain of waste direct to river.

SAMPLING METHOD

The water sample was taken by utilizing the water sampler. About 2100 mL water sample was taken from left, center, and right of the river, each about 700 mL and put into the polyvinyl bottle. 2 mL HNO_3 was added to this bottle.

The sediment sample was taken by utilizing the sampler device Eckman Barge (dredger). A portion of sediment sample was taken and sieving, and packed in polyvinyl bag.

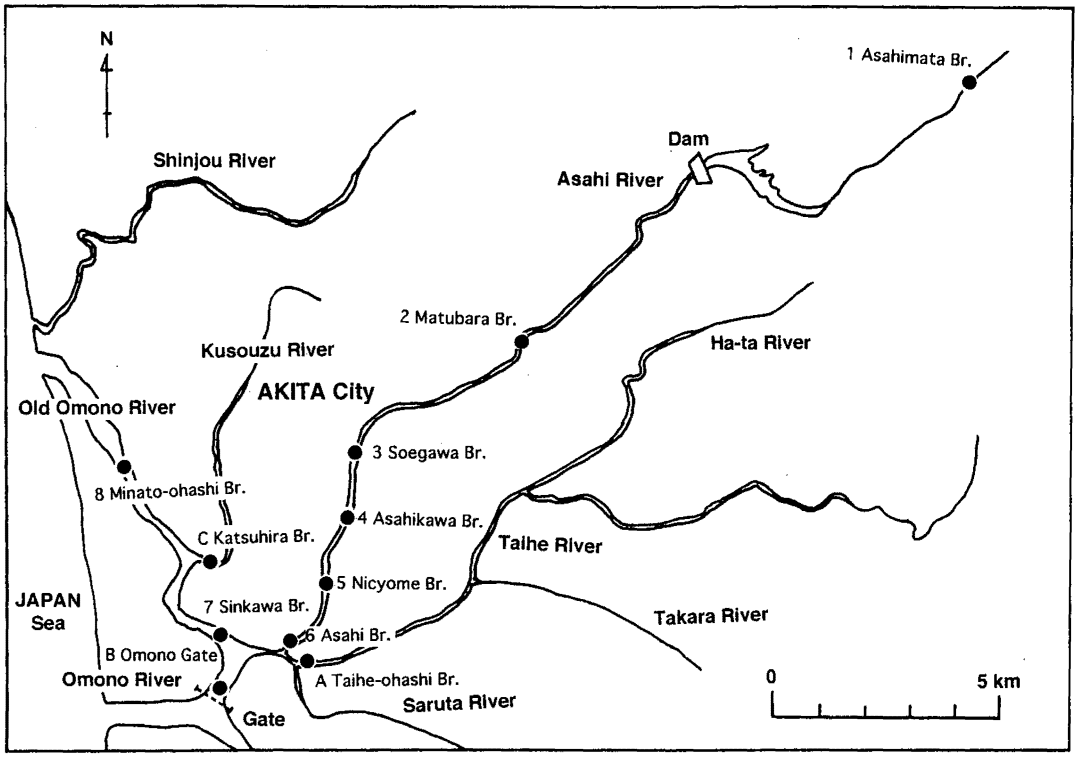

Fig. 1 Sampling point of Asahi River

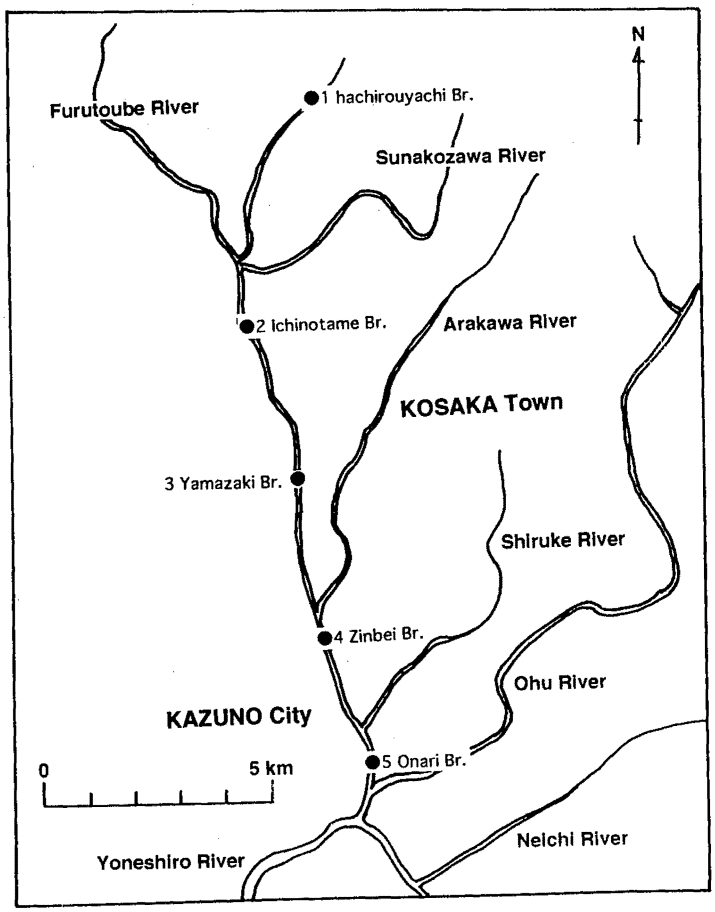

Fig. 2 Sampling point of Kosaka River

DETERMINATION OF ELEMENTS

Seven elements were selected to analysis, i.e : Manganese (Mn), Ion (Fe), Nickel(Ni), Copper (Cu), Zinc (Zn), Lead (Pb), and Cadmium (Cd).

CHEMICALS AND REAGENTS

Selected seven stock solutions (Mn, Fe, Ni, Cu, Zn, Pb, and Cd) of certified Atomic Absorption Spectrometer, 1000 ppm and these were obtained from Kanto Chemical Ltd. Japan and chemical of reagent grade quality (HNO_3, H_2O_2, and HCl) from Wako Chemical Ltd. Japan.

SAMPLE PREPARATION

1 Pretreatment method of water sample.

Fig. 3. shows the analytical procedure of water sample pretreatment.River water sample was treated using direct analysis method (nitric acidly). Volume 250 mL of water sample put into conical beaker 300 mL (triple). 10 mL HNO_3 was added to the beaker and heated on the hot plate (150-200 ℃) for about 4 hours or volume of water sample until about 5-10 mL. Cool it down to room temperature. Filtrated of sample solution with filter paper ADVANTEC 5B. Washing of conical beaker and filter paper about three times with HNO_3 (2+98). Adjust volume until 25 mL with HNO_3(2+98) in test tube 25 mL. This is a solution to be analyzed.

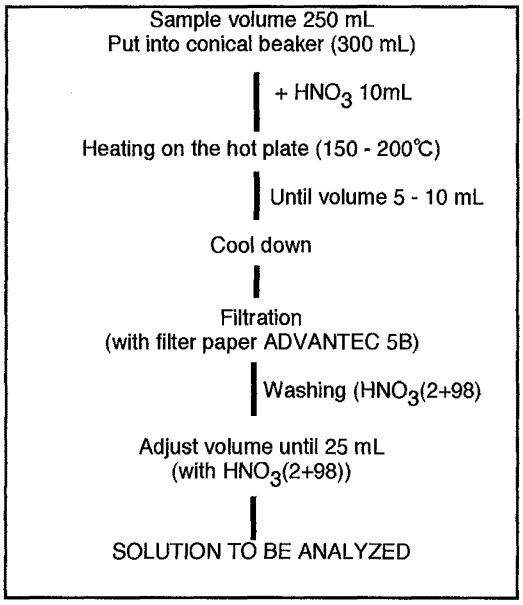

Fig. 3 Analytical procedure of water sample pretreatment

2 Water Content Analysis

Fig.4 shows the analytical procedure for decide of water content.Weighed about 5 g wet sample (Gravimetry^{a}) and put into the gravimetry bottle glass. Heated on the oven (105 ℃) for about 2 hours. Cool it down in the desiccator for about 1 hour and weighed of that sample (Gravimetry$^{a'}$). If (a-a')< 10 mg, this is dry sample for decide of water content.

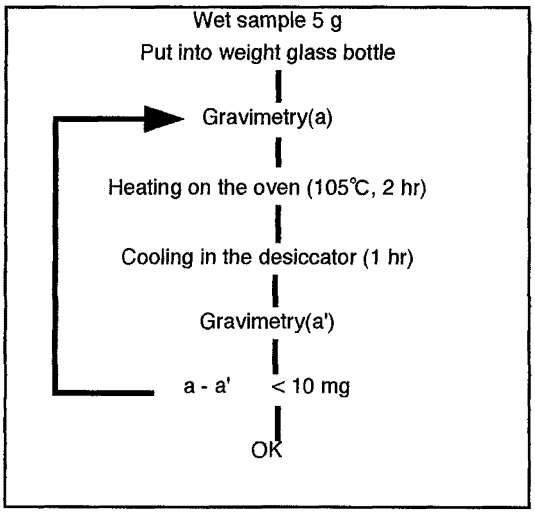

Fig. 4 Analytical procedure for decide water content

3 Pretreatment method of sediment sample

3.1 HNO_3 - H_2O_2 Method (Soft elusion)

Fig. 5 shows the analytical procedure of sediment sample pretreatment, using HNO_3 - H_2O_2 method. Weighed 2 gr of air-dried sample and put into conical beaker 300 mL (triple). The conical beaker covered with a watch glass, and was placed on the hot plate. 15 mL HNO_3 and 5 mL H_2O_2 was added to the beaker and heated on the hot plate (150-200 ℃) for about 2 hours. Cool it down to room temperature. Washing of watch glass with hot distilled water about three times.

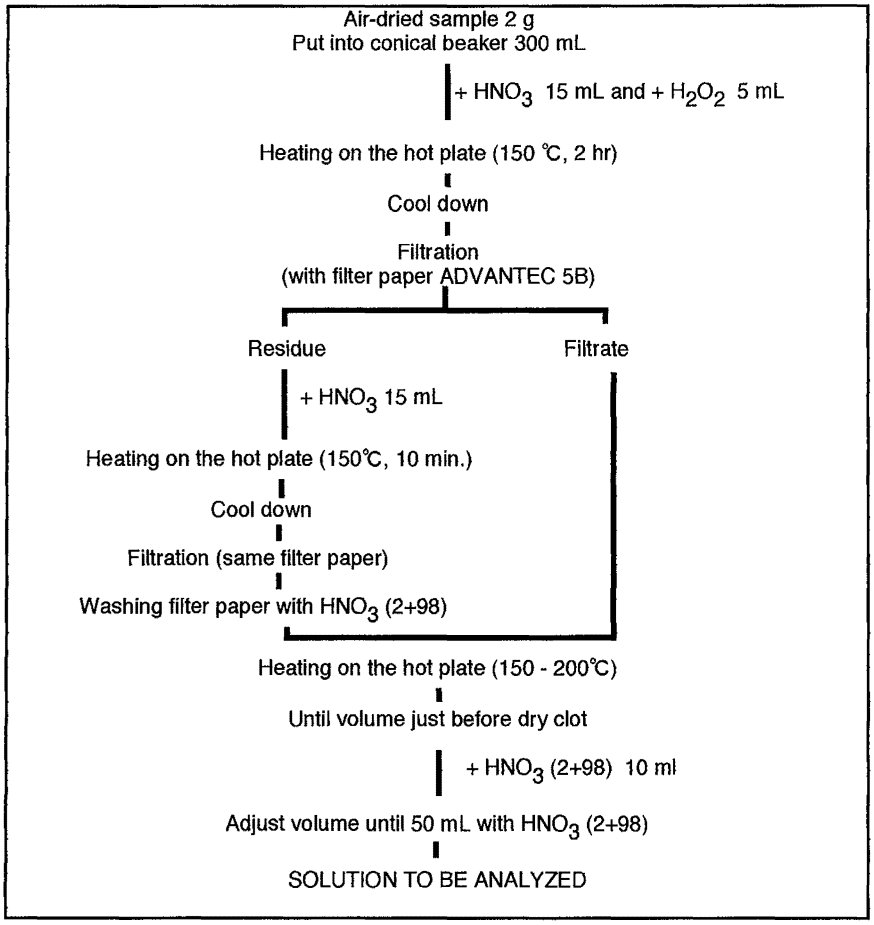

Fig. 5 Analytical procedure of sediment sample pretreatment

The solution was filtrated with filter paper ADVANTEC 5B. The residue put into conical beaker and 15 mL HNO_3 was added into that beaker and heated for about 10 min. Cool it down, and filtration with same filter paper. The solution was heated on the hot plate (150-200 ℃) until volume just before dry clot, cool it down and adjust volume with HNO_3 (2+98) until 50 mL. This is solution to be analyzed.

3.2 HNO_3 - HCl Method (Strong elusion)

Fig. 6 shows the analytical procedure of sediment sample pretreatment, using HNO_3-HCl method. Weighed 2 gr of air-dry sample and put into conical beaker (triple). 10 mL HNO_3 and 20 mL HCl was added to the beaker and heated on the hot plate (150-200 ℃) for about 2 hours. Cool it down to room temperature. 10 mL HNO_3 was added to that beaker and continue the heating until brown/white fume was generated. Cool it down to room temperature , and 50 mL distilled water was added to that beaker. Filtration that solution with filter paper ADVANTEC 5B, and washing of

conical beaker, watch glass and filter paper with HCl (1+10). Continue the heating until volume just before dry clot. Cool it down, adjust volume until 50 mL with HNO_3 (2+98). This is a solution to be analyzed.

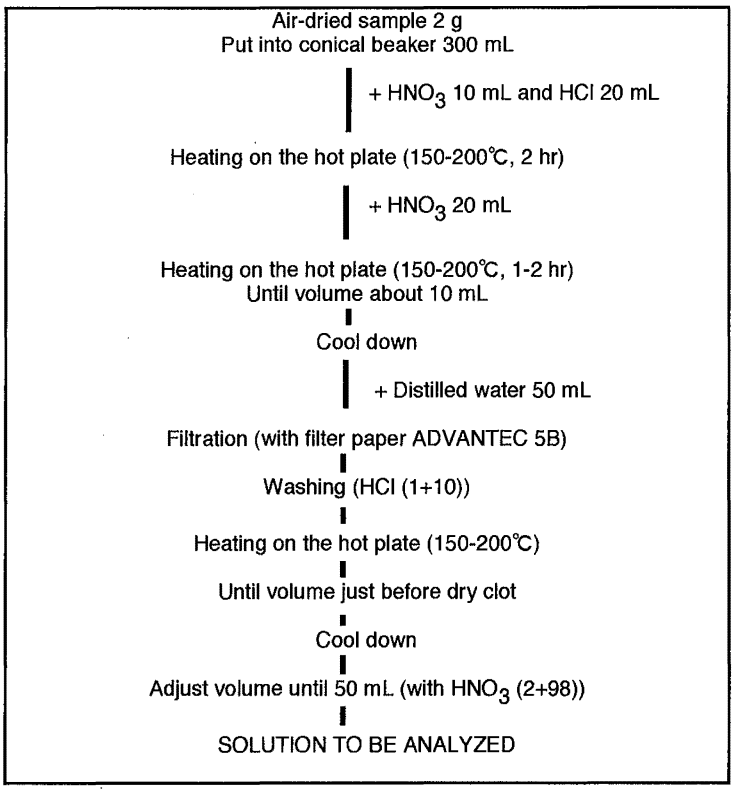

Fig. 6 Analitycal procedure of sediment sample pretreatment

INSTRUMENTATION

Table 1 shows the operating conditions of Atomic Absorption Spectrometer.One set of elements standard solution was prepared to make the calibration curve. Concentration of standard solution as follows;

- Mn and Fe : 2.0; 4.0; 6.0; 8.0; and 10.0 mg/L
- Ni, Cu, Zn, Pb, and Cd : 0.2; 0.4; 0.6; 0.8 ; and 1.0 mg/L

Table 2 shows the elements concentration of determination limit.

Table 1 Operating conditions of AAS

AAS analyzer	: Hitachi 170 - 50 A
Fuel	: C_2H_2 Gas
Fuel flow	: 0.2(Kg/cm2)
Air flow	: 2.0(Kg/cm2)
Lamp current	: 7.5(mA)
Analytical line (nm) and slit	
Mn : 279.5 ; 2	Fe : 248.3 ; 1 Ni : 232.0 ; 1 Cu : 324.8 ; 3
Zn : 213.3 ; 2	Pb : 283.3 ; 1 Cd : 228.8 ; 2

Table 2 Concentrations of determination limit

Mn, Fe	: 0.1(mg/L)
Ni, Cu, Zn, Cd	: 0.01(mg/L)
Pb	: 0.05(mg/L)

RESULTS AND DISCUSSION

Accuracy and Reliability

1 Test water sample

Table 3 shows the accuracy and reliability of elements determination using test water sample. The value of accuracy in water test sample were in the ranges of 0.90 - 0.95. Relatively good accuracy of Fe, Cu, Cd, Pb and Zn, even though accuracy value of Ni less than 0.90. Value of accuracy and reliability shows the operating condition of AAS and method of pretreatment. In this case 250 mL water sample was treated using nitric acidly method and last volume 20 mL.

Table 3 Accuracy and reliability of elements determination using test water sample

	Elements (mg/L)*						
	Mn	Fe	Ni	Cu	Zn	Pb	Cd
1st	0.38	0.39	0.036	0.040	0.038	0.039	0.039
2nd	0.34	0.37	0.036	0.036	0.036	0.035	0.036
3th	0.37	0.38	0.035	0.038	0.036	0.038	0.038
4th	0.36	0.38	0.034	0.038	0.037	0.037	0.038
5th	0.35	0.36	0.034	0.037	0.035	0.036	0.038
Mean(a)	0.36	0.38	0.035	0.038	0.036	0.037	0.038
SD	0.016	0.011	0.0010	0.0015	0.0011	0.0016	0.0011
CV(%)	4.44	2.89	2.86	3.95	3.06	4.32	2.89
Certified value(b)	0.40	0.40	0.040	0.040	0.040	0.040	0.040
a/b	0.90	0.95	0.88	0.95	0.90	0.93	0.95

* Elements concentration determined from three repeat measurement of each sample.

2 National Institute Environmental Study (NIES) test sample

Table 4 shows the accuracy and reliability of elements determination using NIES (National Institute Environmental Study) test sample. Two methods of sediment pretreatment were HNO_3 - H_2O_2 method (soft elusion) and HNO_3 - HCl method (strong elusion). 0.1 g NIES test sample was treated using that methods.

The first method have an accuracy value were in the ranges of 0.95 - 1.74, relatively good accuracy of Cu, Zn, and Pb; even though second method have an accuracy value were in the ranges of 0.86 - 3.47 and relatively good accuracy of Ni, Zn, and Pb. Accuracy value of Cd are not good in the first method and second method too, the first method was 1.59 and second method was 3.49. Not good accuracy value, that happened may be due to not good operating condition of AAS or not good pretreatment. In this case second method is better than first method, because second method moresimple and more efficiency.

Table 4 Accuracy and reliability of elements determination using NIES test sample

	Elements (μg/g)*													
	Mn		Fe		Ni		Cu		Zn		Pb		Cd	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
1st	66	53	4190	3900	19.4	20.8	68.5	55.7	1132	911	215.8	205.7	1.3	4.8
2nd	61	57	4060	4050	21.3	19.7	67.7	56.6	914	1056	222.5	205.4	1.3	4.3
3th	60	79	4010	5860	47.5	20.5	65.8	58.2	789	1004	219.5	211.1	2.5	4.5
4th	67	65	4280	4420	52.0	16.1	68.1	59.1	1014	956	214.0	210.6	1.2	2.9
5th	67	65	4020	4340	20.7	17.7	67.3	59.8	1089	1170	219.7	212.9	2.5	2.7
Mean(a)	64	64	4112	4514	32.2	19.0	67.5	57.9	988	1019	218.3	209.1	1.8	3.8
SD	3.4	10.0	118.2	781.5	16.13	2.00	1.04	1.71	138.5	100.0	3.38	3.39	0.68	0.97
CV(%)	5.33	15.61	2.87	17.31	50.12	10.55	1.54	2.95	14.02	9.81	1.55	1.62	38.47	25.23
Certified value(b)					18.5		67		1040		219		1.1	
a/b					1.74	1.02	1.01	0.86	0.95	0.98	1.00	0.95	1.60	3.49

*Elements concentration determined from three repeat measurement of each sample.

I : HNO_3 - H_2O_2 Method, II : HNO_3 - HCl Method

ELEMENTS CONCENTRATION OF ASAHI RIVER

1 Elements concentration in river water

Table 5 shows the fill trip data of Asahi River. Concentration of various elements in river water of Asahi River are shown in Table 6. Seven elements : Mn, Fe, Ni, Cu, Zn, Pb, and Cd were detected in river water. According to result of survey, generally all of sampling points it could be seen that elements concentration of river water are relatively low, at up stream and down stream too. Concentration of Pb in all of sampling points were no detected, even though concentration of Mn in all of sampling points varied with the ranges from 0.02 to 0.26 mg/L, Fe from 0.02 to 2.0 mg/L, Ni from 0.005 to 0.009 mg/L, Cu from 0.001 to 0.003 mg/L, Zn from 0.006 to 0.052 mg/L, and Cd from 0.001 to 0.002 mg/L.

Highest concentration of Mn, Fe Ni, and Cu were founded in Katsuhira Br., it happened due to in that area there were some industrial facilities where produce of that elements during the process, like metal industry, chemical industry, refinery, electric power industry, plywood, etc. Besides that from domestic activities that potentially produce of that elements. The highest concentration of Zn was founded in Sinkawa Br., that case because near in that place there were any Zn refinery, that potentially produce of Zn waste.

Table 5 Fill trip data of Asahi River*

Sampling point No.	Name of Bridge	Sampling time	Weather	Depth (m)	Wide (m)	Water. temp. (℃)	Weather temp. (℃)	Turbidity (cm)	Water color	sediment type	water content
1	Asahimata	10.00	fine	±1	±10	12.5	20.5	>50	clear	sand	20.33
2	Matsubara	10.45	cloud	±0.5	±50	17.0	22.5	>50	clear	sand	23.74
3	Soegawa	11.05	cloud	±1	±30	16.0	21.0	>50	clear	sand	21.02
4	Asahikawa	11.35	cloud	±0.5	±30	16.0	21.0	>50	clear	sand	20.83
5	Nicyome	12.45	cloud	±1.5	±30	16.0	18.0	>50	clear	sand	22.29
6	Asahi	13.30	cloud	±2	±60	17.0	21.0	45	yellow	sand	22.25
7	Sinkawa	10.00	cloud	±2	±80	19.0	21.5	44	yellow	sand	22.58
8	Minato-ohashi	15.25	cloud	±1	±150	15.0	20.0	49	yellow	sludge	37.22
A	Taihe-ohashi	13.00	cloud	±1	±50	17.0	21.0	45	yellow	sand	22.83
B	Omono Gate	14.20	cloud	±1	±30	19.0	22.5	49	yellow	sand	18.81
C	Katsuhira	15.00	cloud	±1	±20	20.0	21.0	40	yellow	sand	20.93

* Investigation date was 5th September 1995.

Table 6 Concentration of elements in river water sample of Asahi River

Sampling point No.	Name of Bridge	Elements concentration (mg/L)*						
		Mn	Fe	Ni	Cu	Zn	Pb	Cd
1	Asahimata	ND**	0.02	0.008	ND	0.006	ND	0.002
2	Matsubara	0.02	0.09	0.007	ND	0.006	ND	0.002
3	Soegawa	0.02	0.10	0.007	ND	0.006	ND	0.002
4	Asahikawa	0.02	0.16	0.008	ND	0.007	ND	0.002
5	Nicyome	0.03	0.23	0.007	ND	0.006	ND	0.002
6	Asahi	0.09	0.71	0.009	0.001	0.012	ND	0.002
7	Sinkawa	0.07	0.61	0.007	0.002	0.052	ND	0.002
8	Minato-ohashi	0.07	0.62	0.007	0.002	0.034	ND	0.002
A	Taihe-ohashi	0.13	0.95	0.006	0.002	0.011	ND	0.001
B	Omono Gate	0.03	0.42	0.005	0.002	0.007	ND	0.001
C	Katsuhira	0.26	2.00	0.009	0.003	0.024	ND	0.002

* Average from 3 times analysis and 3 repeat measurements.

** Not Detected.

2 Elements concentration in river sediment

Table 7 shows the concentration of elements in river sediment of Asahi River. Highest concentration of Mn, Fe, and Ni were founded in Matsubara Br., concentration of each element were in the ranges Mn (710 - 810 μg/dry weight g), Fe (57700 - 72600 μg/ dry weight g) and Ni (12.2 - 13.6 μg/ dry weight g). Concentration of Zn in up stream was very high (176 - 191 μg / dry weight g). However, those metals are in accurance, Mn and Fe undergoes the precipitation process through oxidation and Mn was taken in certain microorganism. Zn is one of the element which exists in much amount in nature and easily absorbed by sediment and soil.

Concentration of Cu, Zn, Pb, and Cd in down stream more high than in up stream, the highest concentration of that elements was founded in Minato-ohashi Br.(down stream), concentration of Cu with the ranges from 15.3 to 16.0 μg/dry weight g, Zn from 217 to 243 μg/dry weight g, Pb from 21.0 to 29.3 μg/dry weight g and Cd from 3.0 to 3.2 μg/ dry weight g. Around those area there were some industrial, like metal industry, chemical industry, plywood industry, paper industry, oil container, refinery, etc., and domestic activities that potentially produce of that elements.

Concentration of Pb and Zn in up stream almost same with in down stream. In up stream there was no industrial activities, higher concentration of that elements maybe due to from old mine or characteristic of sediment that content of Pb and Zn in much amount in nature.

Table 7 Concentration of elements in river sediment sample of Asahi River

Sampling point No.	Name of Bridge	Elements concentration (μg/dry weight g) * Mn	Fe	Ni	Cu	Zn	Pb	Cd
1	Asahimata	710 - 740	60100 - 69300	7.7 - 9.4	12.1 - 13.9	176 - 191	21.8 - 24.5	1.2 -1.4
2	Matsubara	710 - 810	57700 - 72600	12.2 - 13.6	10.2 - 13.4	120 - 145	16.6 - 23.1	1.2 - 1.5
3	Soegawa	490 - 640	34100 - 42800	8.3 - 10.3	7.8 - 14.8	79 - 104	11.0 -15.0	0.8 - 0.9
4	Asahikawa	450 - 550	43100 - 53900	8.2 - 9.8	7.5 - 8.4	112 - 126	13.0 - 14.1	0.9 - 1.1
5	Nicyome	380 - 530	27400 - 43700	6.7 - 8.7	5.6 - 9.0	84 - 109	10.9 - 12.2	0.7 - 0.8
6	Asahi	350 - 380	44800 - 47300	11.3 - 12.2	14.7 -16.7	156 - 165	20.3 - 21.9	0.9 - 1.0
7	Sinkawa	430 - 480	58200 - 61400	11.4 - 12.0	9.7 - 11.2	147 - 151	17.8 - 25.4	1.3 - 1.6
8	Minato-ohashi	200 - 220	38200 - 41100	10.7 - 12.1	15.3 - 16.0	217 - 243	21.0 - 29.3	3.0 - 3.2
A	Taihe-ohashi	190 - 200	32400 - 34800	7.6 - 8.4	5.6 - 7.5	76 - 81	11.7 - 12.6	0.7- 0.9
B	Omono Gate	390 - 440	28500 - 34900	7.1 - 7.7	9.4 - 11.2	77 - 87	13.1 - 14.1	0.9 - 1.0
C	Katsuhira	180 - 190	24600 - 30100	6.5 - 7.0	6.3 - 8.7	149 - 157	11.5 - 11.8	0.7 - 0.8

* Concentrations were 3 repeat measurements.

3 Elements concentration of Asahi River

Fig. 7 shows the relative abundance of elements in river water and river sediment per sampling location in Asahi River. Environmental monitoring by analysis of river sediment sample is required to be performed to evaluate the water quality in the river comprehensively. It is conceivable that many kinds of pollutants, brought in through a wide variety of channels, are accumulated on the bottoms of river. Generally concentration of elements in river sediment higher than river water. River sediment accumulates pollutants in water, so that the concentration in sediment is usually higher than in water.

Highest concentration of elements in river water were founded in Katsuhira Br., except Zn, but in river sediment that area content of lowest Mn, Fe, and Ni. Highest concentration of that elements in river sediment were founded in Matsubara Br., even though Cu, Zn, Pb and Cd were founded in Minato-ohashi Br. (down stream). In this case the result shows, that quality of river water different with river sediment.

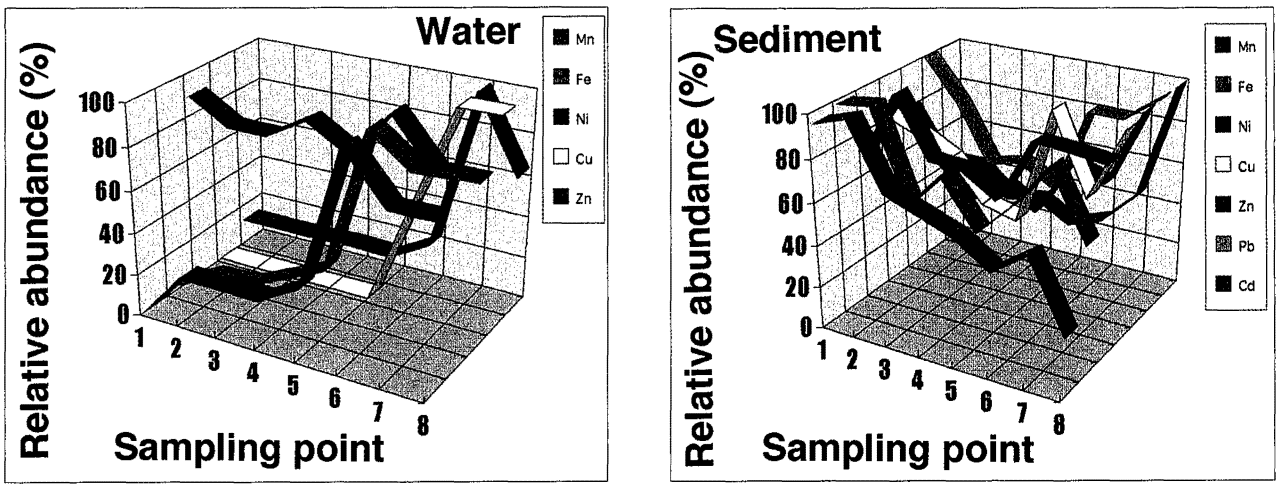

Fig. 7 Relative abundance of elements per sampling location in Asahi River

ELEMENTS CONCENTRATION OF KOSAKA RIVER

1 Elements concentration in river water

Table 8 shows the fill trip data of Kosaka River. The concentration of various elements in river water of Kosaka River are shown in Table 9. Concentration of elements in all of sampling points varied, concentration of each elements with the ranges; Mn (0.01 - 0.008 mg/L); Fe (0.81 - 2.23 mg/L); Ni (0.008 - 0.012 mg/L); Cu (0.003 - 0.015 mg/L); Zn (0.004 - 0.082 mg/L); Pb (0.002 - 0.007 mg/L), and Cd (0.001 - 0.002 mg/L).

The highest concentration of Mn was founded in Ichinotame Br. (sampling point No. 2), even though Ni in Zinbei Br. (sampling point No. 4). Yamazaki Br.(sampling point No. 3) content of highest Fe, Cu, Zn, Pb, and Cd. It happened because near that area (about 1 km before), there were any Zn, Cu refinery, metal industry, etc, and domestic activities that potentially produce Zn, Cu, Pb and Cd waste. That industry maybe haven't waste water treatment and drain of waste water direct to river, so that river water content of highest elements, especially heavy metals.

Concentration of Cd in river water almost in all of sampling points were relatively low. The concentration of Cd in river water relatively low but if accumulation process is happened in human body via food chain process, certain amount of Cd will be toxic and can make interference to arterial blood vessel, kidney and lungs (Mc Neely, R.N., et all.,1979).

Table 8 Fill trip data of Kosaka River*

Sampling point No.	Name of Bridge	Sampling time	Weather	Depth (m)	Wide (m)	Water. temp. (℃)	Weather temp. (℃)	Turbidity (cm)	Water color	sediment type	water content
1	Hachirouyach	09.25	fine	±0.5	±6	13.0	18.5	>50	clear	sand	22.57
2	Ichinotame	09.40	fine	±1	±10	14.5	20.0	>50	clear	sand	26.72
3	Yamazaki	10.10	fine	±1	±8	15.5	20.0	>50	clear	sand	24.75
4	Zinbei	10.30	fine	±1	±5	17.0	22.0	>50	clear	sand	25.61
5	Onari	10.45	fine	±0.5	±60	16.5	22.0	>50	clear	sand	31.71

* Investigation date was 19th September 1995.

Table 9 Concentration of elements in river water sample of Kosaka River

Sampling point No.	Name of Bridge	Elements concentration (mg/L)*						
		Mn	Fe	Ni	Cu	Zn	Pb	Cd
1	Hachirouyachi	0.01	0.81	0.008	ND**	0.004	0.002	ND
2	Ichinotame	0.08	1.93	0.009	0.003	0.022	0.003	ND
3	Yamazaki	0.07	2.23	0.010	0.015	0.082	0.007	0.002
4	Zinbei	0.05	1.60	0.012	0.010	0.060	0.006	0.001
5	Onari	0.05	1.74	0.011	0.010	0.064	0.006	0.001

* Average from 3 times analysis and 3 repeat measurements.

** Not Detected.

2 Elements concentration in river sediment

The results showed (table 10) that the highest concentration of Mn, Fe, and Ni was founded in Hachirouyachi (up stream). Concentration of each elements were in the ranges Mn (760 - 780 μg/dry weight g), Fe (27500 - 29300 μg/dry weight g), and Ni (11.4 - 11.7 μg/dry weight g). That cases because Mn and Fe undergoes the precipitation process through oxidation and Mn was taken in certain microorganism. Zn is one of the element which exists in much amount in nature and easily absorbed by sediment and soil.

Yamazaki Br. (sampling point No. 3) content of highest Cu, Zn, Pb, and Cd, concentration of each elements were in the ranges Cu (142 - 237 μg/dry weight g), Zn(990 - 1540 μg/dry weight g), Pb (177 - 264 μg/dry weight g), and Cd (2.8 - 3.1 μg/dry weight g). Near that area, there were any Zn, Cu refinery, metal industry, and domestic waste, that potentially produce of that elements.

Table 10 Concentration of elements in river sediment sample of Kosaka River

Sampling point No.	Name of Bridge	Elements concentration (μg/dry weight g) *						
		Mn	Fe	Ni	Cu	Zn	Pb	Cd
1	Hachiroyaci	760 - 780	27500 - 29300	11.4 - 11.7	24.1 - 26.5	116 - 124	21.8 - 22.9	1.4 - 1.5
2	Ichinotame	610 - 640	18600 - 20900	5.4 - 6.3	18.7 - 19.6	128 - 136	19.4 - 28.2	1.1 - 1.2
3	Yamazaki	590 - 660	21400 - 24800	7.4 - 8.1	142 - 237	990 - 1540	177 - 264	2.8 - 3.1
4	Jinbei	400 - 530	19200 - 23300	6.2 - 6.7	90 - 112	560 - 610	109 - 126	2.1
5	Onari	440 - 450	19400 - 19700	7.4 - 7.8	113 - 126	430 - 470	98 - 107	2.5 - 2.7

* Concentrations were 3 repeat measurements.

3 Elements concentration of Kosaka River

Fig. 8. shows the relative abundance of elements in river water and river sediment per sampling location in Kosaka River. According to results, highest concentration of Cu, Zn, Pb, and Cd were founded in Yamazaki Br., at river water and river sediment too. That happened because effect of industry and domestic waste were very high and direct to river quality.

River sediment in Hachirouyachi (up stream) content of highest Mn, Fe and Ni, but in river water content of lowest that elements. It happened because characteristic of sediments that content of Mn, Fe and Ni in much amount in nature.

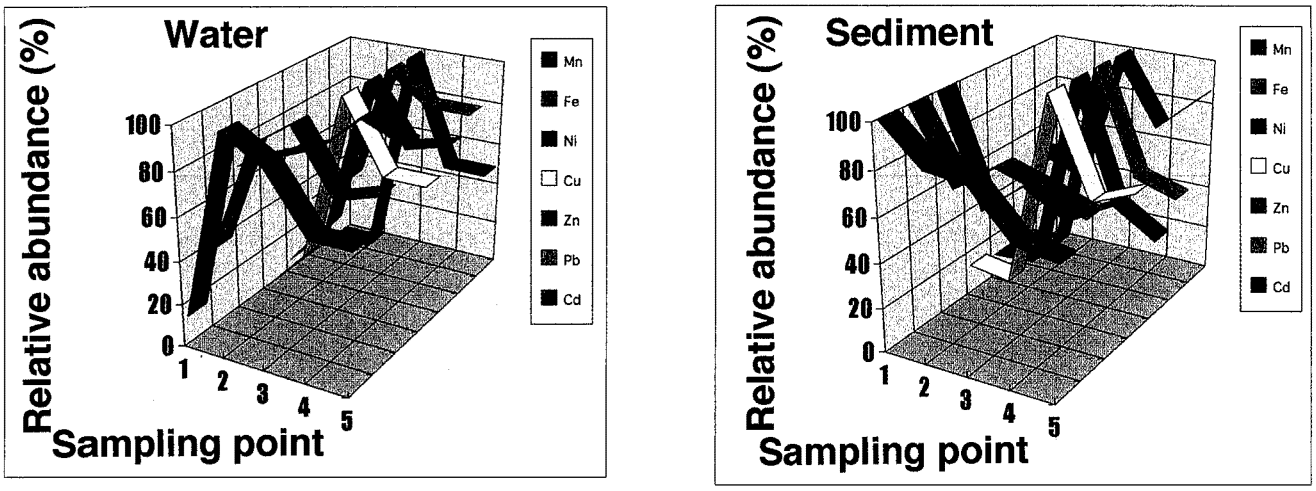

Fig. 8 Relative abundance of elements per sampling location in Kosaka River

COMPARE BETWEEN ASAHI RIVER AND KOSAKA RIVER

Generally it could be seen that concentration of elements in Kosaka River more high than Asahi River. That happened due to in Kosaka River there were some mine , although all of mine already closed now, but effect of that mine to river quality, especially to river sediment was very high. All types of soil/sediment degeneration soil/sediment pollution is of a cumulative type of heavy metals and other hazardous matter. On the other hand there are cases in conjunction with the redevelopment of urbanized areas in recent years where toxic substances has penetrated the soil due to accidents, such as the breakdown and damage of facilities at factories, and to illegal waste disposal.

CONCLUSION

1. Concentration of elements in river water of Asahi River, are relatively low, in up stream and down stream too.
2. Concentration of Mn, Fe, and Zn in river sediment were highest in Matsubara Br., even though concentration of Cu, Zn, Pb, and Cd were highest in Minato-ohashi Br. (down stream).
3. At Kosaka River concentration of Mn, Fe, and Ni in river sediment were highest in Hachirouyachi Br. (up stream).
4. Highest concentration of Cu, Zn, Pb, and Cd was founded in Yamazaki Br. in river water and river sediment too.
5. Generally concentration of elements in Kosaka River more high than Asahi River.