

It was doubtful the reproducibility of cadmium values examined from the repeated sampling in the dry season survey, the rainy season survey and the duplicate samples; therefore cadmium is also excluded from further description. Ten samples were analyzed in the supplementary survey on June 2003, and most of the analytical values were below the detection limit (0.0001 mg/L) and maximum value was 0.0003 mg/L.

The number of sampling sites are described both the number in the dry season and the rainy season (the number in the dry season | that in the rainy season) in the following descriptions.

- Al Fig.3-1-3(1): The number of sites above the threshold values 0.2 mg/L were 1 | 4 in the Rewa drainage system, 2 | 3 in the Navua drainage system, and 0 | 1 in Sigatoka drainage system. The rainy season's values tends higher than the dry season's values.
- As Fig.3-1-3(1): Arsenic in the dry season detected (0.001 mg/L and above) a site in Rewa and five sites in Sigatoka, while 46 sites in the rainy season; however the maximum values were relatively low as 0.006 mg/L.
- Cr Fig.3-1-3(1): Chromium in the dry season detected (0.001 mg/L and above) four sites in Rewa and six sites in Sigatoka, while 35 sites in the rainy season. . The rainy season's values tend to be higher than the dry season's values.
- Cu Fig.3-1-3(2): The number of sites above threshold values (0.004 mg/L | 0.005 mg/L) were 4 | 5 in Rewa, 4 | 3 in Sigatoka, and 1 | 0 in coastal drainage system.
- F Fig.3-1-3(2): Fluorine in the dry season detected (0.1 mg/L and above) seven sites in Sigatoka, while in the rainy season 19 sites in Sigatoka and three sites in other drainage systems. The sites of F above the detection limit values were concentrated in the Sigatoka River system.
- Fe Fig.3-1-3(2): The number of sites above the threshold values 0.2 mg/L were 2 | 5 in Rewa, 1 | 0 in Navua, 0 | 2 in Sigatoka, and 1 | 0 in the coastal system.
- Mn Fig.3-1-3(2): The number of sites above the threshold values 0.03 mg/L were 2 | 2 in Rewa, 0 | 1 in Navua, 4 | 3 in Sigatoka, and 4 | 3 in the coastal system. Almost the same sites both in the dry season and the rainy season detected the values above the threshold.
- P The values was less and 0.007mg/L or less in the dry season. The number of sites above the threshold values 0.06mg/L in the rainy season were seven sites in Rewa, a site in Navua, and two sites in Sigatoka. The rainy season's values tends higher than the dry season's values.
- Zn Fig.3-1-3(2): The values was 0.106 mg/L or less in dry season. The number of sites above the threshold values 0.15 mg/L in rainy season were four sites in Rewa, and three sites in Sigatoka. The rainy season's values tend to be higher than the dry season's values.

(5). The difference between dry season and rainy season

The values of EC and major dissolved components (TDS , Na , Mg , HCO₃ , Cl) in the dry season show lower than those in the rainy season. It means that major dissolved compositions were diluted by much water according as high precipitation in the rainy season. While, flow rate, turbidity, some of minor components (Al, As, Cr, Zn) in the rainy season show higher values than those in the dry season. It means that these minor components were not diluted by much volume water in the rainy season, and caused by other factor. For example, these elements might exist as small particulate form and pass through filter, but

this increase of minor components is not always concordant with the distribution of turbidity Fig.3-1-3(1).

(6). Comparison with guideline values

The ADWG (Australian Drinking Water Guidelines), WHO Guidelines for Drinking-water Quality, the drinking water quality standards of Ministry of Health, Labour and Welfare in Japan are shown in Table 3-1-1, and the analytical values of the river water of the survey area were compared with the regulation value of ADWG (Australian Drinking Water Guidelines). The following elements show higher in comparison with ADWG values: Al, Cr, Fe, Ni, Pb and Se. The locations and the levels of high concentration samples, except selenium because of near values of detection limit, are drawn in Fig.3-1-4; there analytical values are divided by ADWG values. High values were almost found in Rewa River and Navua River. And a number of samples with high values increased in the rainy season.

Table 3-1-1. Comparison with chemical composition and the values of guidelines

Element	Limit of reporting	Range (Dry+Rainy)		Guidelines		
		MIN.	MAX.	ADWG	WHO	JAPAN* (health)
Na	1 mg/L	4	26	180		
SO ₄	1 mg/L	<1	40	250		
Cl	1 mg/L	<1	22	250		
B	0.1 mg/L	<0.1	0.2	4	0.3	1
Fe	0.01 mg/L	<0.01	3.37	0.3		
Se	0.01 mg/L	<0.01	0.03	0.01	0.01	
Ag	0.001 mg/L	<0.001	0.005	1		
Al	0.01 mg/L	<0.01	2.93	0.2		
As	0.001 mg/L	<0.001	0.006	0.007	0.01	0.01
Ba	0.001 mg/L	<0.001	0.02	0.7	0.7	
Cr	0.001 mg/L	<0.001	0.261	0.05	0.05	0.05
Cu	0.001 mg/L	<0.001	0.027	2	2	
Mn	0.001 mg/L	<0.001	0.098	0.1	0.5	
Mo	0.001 mg/L	<0.001	0.002	0.05	0.07	
Ni	0.001 mg/L	<0.001	0.027	0.02	0.02	
Pb	0.001 mg/L	<0.001	0.231	0.01	0.01	0.01
Sb	0.001 mg/L	<0.001	<0.001	0.003	0.005	
Zn	0.001 mg/L	<0.001	0.492	3		
Hg	0.0001 mg/L	<0.0001	<0.0001	0.001	0.001	0.0005
CN	0.001 mg/L	<0.001	0.006	0.08	0.07	nd
F	0.1 mg/L	<0.1	0.2	1.5	1.5	0.8
NH ₃ (N)	0.01 mg/L	<0.01	0.1	0.5		
NO ₂ (N)	0.01 mg/L	<0.01	0.01	3		10
NO ₃ (N)	0.01 mg/L	<0.01	0.26	100		10
Sulfide	0.1 mg/L	<0.1	<0.1	0.05		

(7). Weather observation data

A weather station was installed in the Namosi Secondary School and weather observation have been carried out continuously. The weather station is automatically acquired the data of temperature, precipitation, relative humidity, wind speed and direction, and insolation at ten minutes intervals. The obtained data from September 19, 2002 to December 22, 2003 were compiled.

The five years meteorological data from six observation stations including Keiyasi, Monasavu, Nacocolevu, Tokotoko, Suva and Nausori: were observed by the Department Meteorology of Fiji government. Data were also collected and compiled including monthly precipitation as shown in Fig.3-1-5.

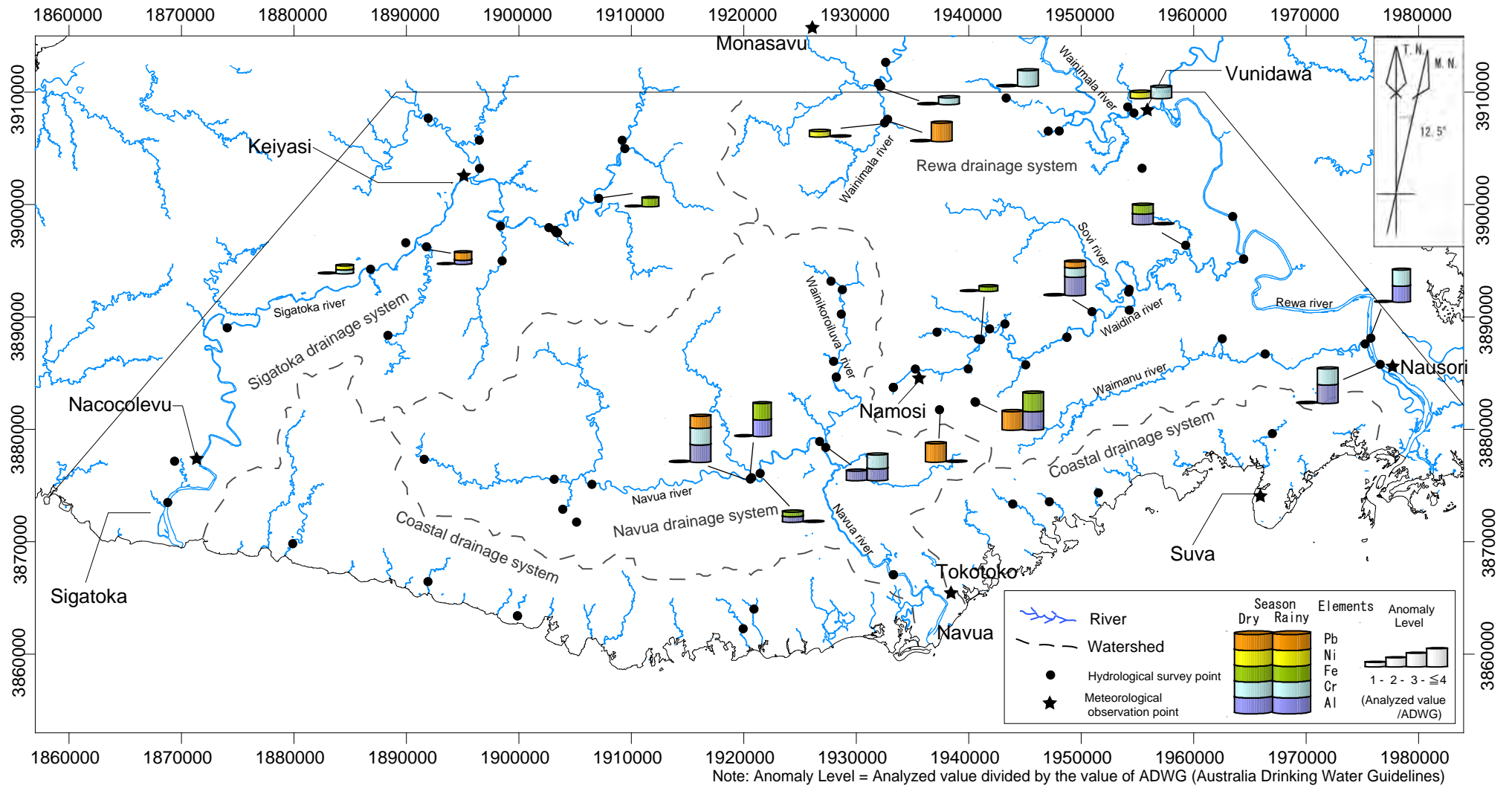


Fig.3-1-4. Quality of the surface water samples

Comparing observed data in Namosi area between the dry season (October) and the rainy season (January), seasonal variation can be clearly seen in temperature and precipitation. The maximum temperatures in October was 33.6°C while in January was 33.9°C. The minimum temperatures was 15.1°C in October and 20.2°C in January. The mean temperatures was 22.9°C in October and 25.8°C in January. Monthly precipitation in October was 174.6 mm and 479.2 mm in January. Thus the daily highest precipitation was 52 mm in October while 107 mm in January.

The average of annual precipitation of Monasavu, located the central part of the Viti Levu island, recorded 5,237 mm: the highest among six stations, while those of Keiyasi and Nacocolevu along the Sigatoka River were 2,640 mm and 1,940 mm respectively.

Annual precipitation in 2003 was the lowest among the past five years.



Fig.3-1-5. Monthly precipitation in the Viti Levu South Area

3.2. Stream sediment survey

Total of 1,845 stream sediment samples (including 128 duplicated samples) were collected from 1,717 locations in the study area during 2002 and 2003. The multi-element analytical data of stream sediment samples revealed the outline of geochemical characteristic in the study area.

(1). Method

Stream-sediment samples were passed through an 80-mesh (180 μm) sieve and the only finer fraction was corrected in the field. The samples were shipped to the laboratory of ALS Chemex in Canada for chemical analysis.

In the Laboratory, HF-HNO₃-HClO₄ triple acid digestion was used for multi-elements analysis except Au and Hg. This digestion is normally considered to be "near total". The resulting cake was leached with hydrochloric acid, and multi-elements were determined by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) method. Gold was analyzed by Fire Assay- Atomic Absorption Spectroscopy procedures. Mercury was determined by the procedure using conventional cold vapour atomic absorption spectroscopy. Analyzed elements and its detection limits are as below:

Au	(0.001 - 2) or (0.05 - 10)	Ca	(0.01% - 25%)	Mg	(0.01% - 15%)	Pb	(2 - 10,000)
Ag	(0.5 - 100)	Cd	(0.5 - 500)	Mn	(5 - 10,000)	S	(0.01% - 10%)
Al	(0.01% - 25%)	Co	(1 - 10,000)	Mo	(1 - 10,000)	Sb	(5 - 10,000)
As	(5 - 10,000)	Cr	(1 - 10,000)	Na	(0.01% - 10%)	Sr	(1 - 10,000)
Ba	(10 - 10,000)	Cu	(1 - 10,000)	Ni	(1 - 10,000)	Ti	(0.01% - 10%)
Be	(0.5 - 1000)	Fe	(0.01% - 25%)	P	(10 - 10,000)	V	(1 - 10,000)
Bi	(2 - 10,000)	Hg	(0.01 - 100)	W	(10 - 10,000)		
		K	(0.01% - 10%)	Zn	(2 - 10,000)		Unit: ppm

(2). Statistical analysis

The analytical values were transformed to their common logarithms to stabilize their variance for all subsequent statistical analyses. The primary statistical tools used to determine threshold levels for anomalous values were univariate statistics and probability plots of analytical values. Prior to performing calculations, the values below the detection limits was replaced values that is one-half the detection limit, and the values above the upper limit was replaced upper limit values.

The analytical values below the detection limit of Ag, As, and Bi have accounted for more than 75 %. Almost analytical values of W were the values below the detection limit.

(3). Geochemical characteristics

The geochemical maps of 20 elements are shown in Fig.3-2-1 (1) and (2). The distribution of these elements displayed the special background and anomalies controlled by the different geological units and influenced by mineralization.

The elements contents of the constituents of major rock forming minerals such as Al, Ca, K, Na, Mg and P in the stream sediment samples is thought to indicate the background values of the local geology. Among these elements, high content of Ca, Na and Mg are found in the northwest of the study area. In particular, the samples of the middle reaches of Sigatoka River indicated high Ca and Mg content because carbonate rocks are widely distributed there. The K anomaly found in the area around the big scale