hornblende porphyry crop out in Namosi-Waisoi mineral occurrences. These porphyries underwent potassic alteration and silicification.

More than 15 porphyry copper mineral occurrences were discovered around the Namosi-Waisoi mineralized zone in the center of the area, such as Waisoi, Waivaka and Wainabama. Mineralization is recognized around the boundary between the Namosi Andesite and the Colo Plutonic Suite.

Some placer gold deposits are known in the Waimanu River basin. At the Wainadoi, gold mineralization is found at the boundary between the Wainimala Group and the Colo Plutonic Suite.

The Colo - i - Suva Zn-Cu-Au-Ag mineral occurrence is north of Suva and consists of small massive sulfide deposit in dacite. The Wainaleka mineral occurrence: possibly a Kuroko-type Cu-Zn deposit, and the Rama Creek mineral occurrence: possibly a porphyry copper type Cu-Au deposit are found in the Navua River basin. The Nakoro Zn-Cu-Pb-Ag-Au volcanogenic massive sulfide deposits and a small scale of the Sulua Creek and Korotogo Cu-Zn mineral occurrences is hosted by the Wainimala Group in the Sigatoka River basin.

2.5. Environmental regulations

The Fiji Government is now improving its environmental policy.

The Ministry of Environment has administered the “Biodiversity Strategy and Action Plan, 1999” to facilitate the protection and sustainable use of Fiji’s biodiversity.

The presently deliberating “Sustainable Development Act” will be included the provisions of Environmental Impact Assessment (EIA) including mining activity such as development, rehabilitation and tailing treatment, environmental regulations, natural resources administrative scheme, and the rules against violation.

The “National Trust of Fiji Act” and “Amendment Act, 1988” prescribes research and preservation of environmental conserved areas in the Fiji Islands: including Sovi Basin, Monosavu-Nadrau Plateau and Rewa Delta in the area.

The “Preservation of Objects of Archaeological and Palaeontological Interest Act, 1940” provides for the preservation of objects of archaeological and palaeontological interest.

The WHO standards are adopted for Fijian environmental standards such as the water quality standard.

Chapter 3. Result of the environmental baseline study

3.1. Hydrological survey

The observation and chemical analysis were carried out for a total of 176 surface water samples including 16 duplicated samples collected from 80 locations in the study area. Samples were analyzed at ALS Environmentals in Australia. The period of field survey was as follows.

Phase 1 survey (dry season)	September 20, 2002 to October 24, 2002
(rainy season)	January 20, 2003 to February 1, 2003
Phase 2 survey	June 28, 2003 to July 1, 2003

A weather station was also set up in the Namosi village secondary school for two years to observe meteorological data. This data and other surrounding six observation stations data obtained from the Fiji Meteorological Service were statistically compiled.

(1). Physical characteristics

Both the observed values in the dry season and the rainy season (a value in the dry season | that in the rainy season) are described as follows.

Flow rate: The minimum flow rates were 0 m^3/sec | 0 m^3/sec and the maximum were 339 m^3/sec | 255 m^3/sec, while the means values were 13.3 m^3/sec | 25.5 m^3/sec. The mean value of flow rate in rainy season indicates two times high than that in the dry season.

Water temperature: The minimum temperatures were 21.3°C | 22.2°C and the maximum were 30.6°C | 30.5°C, while the mean values were 24.4°C | 25.7°C. The mean values of water temperature indicates approximately 2°C | 3°C low than the mean values of monthly average surface temperatures (26.3°C | 28.9°C) in Suva. No systematic differences are found between drainage systems.

Turbidity: The minimum turbidities were 0 mg/L | 0 mg/L and the maximum were 28 mg/L | 333 mg/L. Hence the turbidity becomes clearly high in the rainy season.

EC (Electric Conductivity): The minimum EC values were 3.5 mS/m | 3.4 mS/m and the maximum were 40.7 mS/m | 22.4 mS/m, while the mean values were 13.1 mS/m | 9.18 mS/m. The water in the Sigatoka River system shows higher EC values than the water in other drainage systems.

(2). Chemical index

pH: The minimum values of pH were 6.39 | 6.10 and the maximum were 8.44 | 8.12, while the mean values were 7.72 | 7.38, indicating variation from weak acid water, neutral to weak alkaline water. The mean values in the Rewa River system showed 7.5 | 7.16, and those in the Sigatoka River system showed 8.11 | 7.73. In these systems, pH becomes slightly low in the rainy season.

DO (Dissolved Oxygen): The minimum values of DO were 4.78 mg/L | 4.40 mg/L and the maximum were 15.4 mg/L | 14.1 mg/L, while the mean values were 10.8 mg/L | 7.53 mg/L. No systematic differences are found between the water from different drainage systems.

COD (Chemical Oxygen Demand): The minimum values of COD were <1.0 mg/L | <1.0 mg/L and the maximum were 51.0 mg/L | 62.0 mg/L, while the mean values were 8.2 mg/L | 18 mg/L. The

water in the Sigatoka River system shows higher COD values than the water in other drainage systems.

Hardness: The minimum values of hardness were 11 mg/L | 12 mg/L and the maximum were 153 mg/L | 115 mg/L, showing wide range of values. The mean values in the Rewa River system were 25.2 mg/L | 25 mg/L, those in the Sigatoka River system were 84.6 mg/L | 69 mg/L, and those in the Navua River system were 45.4 mg/L | 35 mg/L.

(3). Major dissolved components

Generally EC values mainly indicate chlorine content in water. The distribution of chlorine is shown in Fig. 3-1-3(1). The values of all sampling sites in rainy season were lower than those in dry season.

On Stiff diagram (Fig.3-1-1), the values are plotted as milli-equivalents per litter (mEq/L) on a horizontal axis extending on each side of a zero vertical axis. Cations concentrations are plotted to the left of zero, while anion concentrations are plotted on the right. The shapes for anions composition (Cl^-, HCO_3^-, SO_4^{2-}) in all water samples show spear types on stiff diagrams and it means the abundance of HCO_3. The shapes for cations composition (Na^+, Ca^{2+}, Mg^{2+}) in the Sigatoka River are spear type and it means the abundance of Ca^{2+}, while the concentration patterns of cations in other three drainages (Rewa, Navua and Coastal) show flat, indicating almost same values of these anions. The high Ca and HCO_3 values in the Sigatoka River could be influenced by the distribution of carbonate rocks.

Piper diagram (Fig.3-1-2) plots the major ions as percentages of milli-equivalents in two base triangles: anions (HCO_3 and CO_3, Cl, SO_4) as well as the cations (Na and K, Ca, Mg) and the data points in the two triangles are projected onto an adjacent grid. Four classifying different types of water on Piper diagram are as bellows:

(I) Non-carbonate hardness territory. This composition is not common in the underground water.

(II) Carbonate hardness territory. Water contains abundantly Ca $(HCO_3)_2$ and Mg $(HCO_3)_2$. This composition is found mainly of free water, and also is the underground water of circulating supply type.

(III) Carbonate alkali territory. Water contains abundantly Na_2CO_3 and K_2CO_3. Confined water is plotted in this territory and shows stagnant ground water.

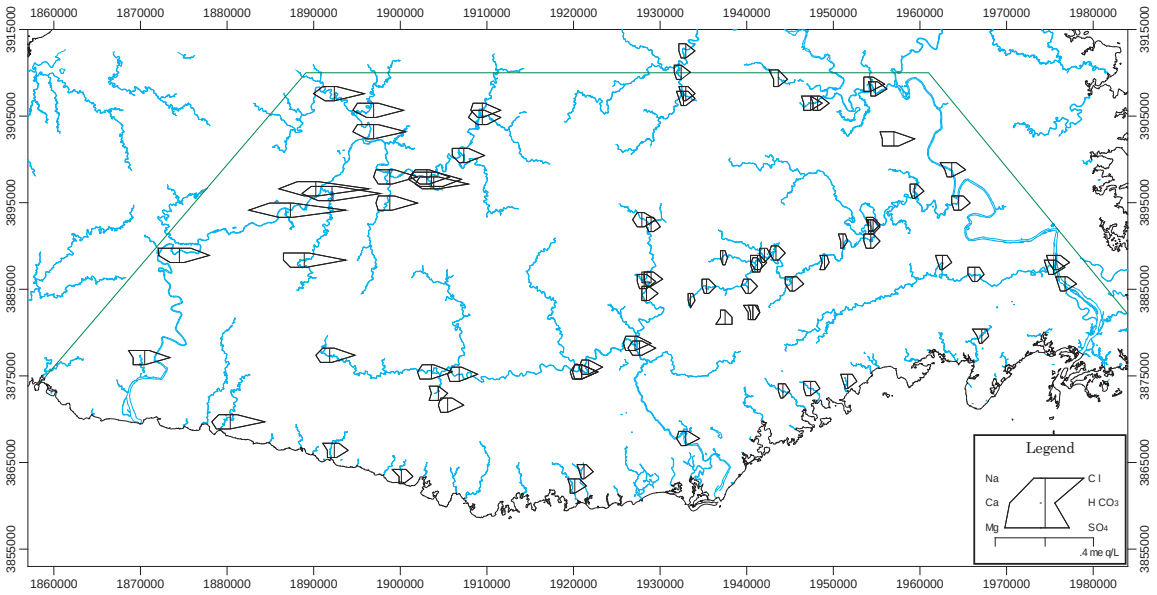
(IV) Non-carbonate alkali territory. Water is rich in chloride and sulfate as mixed with seawater or fossil seawater.

The surface water in this survey area tends to contain rich in HCO_3 as anion and rich in Ca as cation. Therefore all water samples in this area belong to type-II category that is the Carbonate Hardness territory.

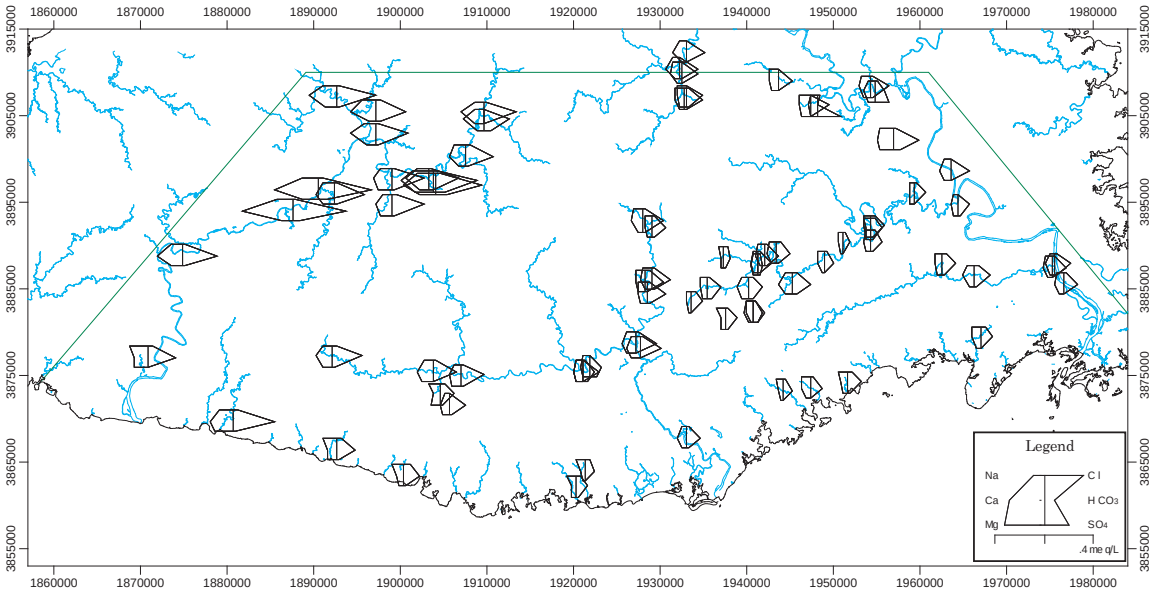
(4). Minor components

The distribution of minor components content are shown in Fig.3-1-3(1)～(2). The maximum values and minimum values are in Table 3-3-1.

The elements that most of analytical values are below the detection limits are Ag, B, CN, F, Hg, Mo, Sb, Se, Pb and Sulfide. The detected elements, but relatively low concentrations, are Ba, N(NH_3), and N(NO_3). These elements are excluded from further descriptions.



Dry Season



Rainy Season

Fig.3-1-1. Stiff diagrams of the surface water chemical compositions

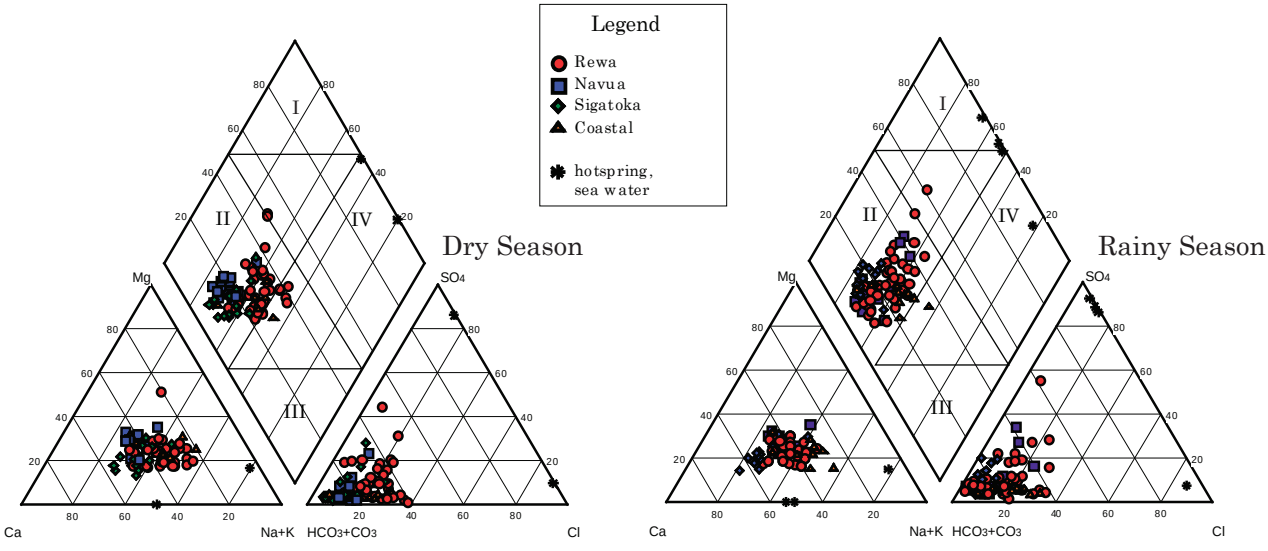


Fig.3-1-2. Piper plot of the surface water chemical compositions