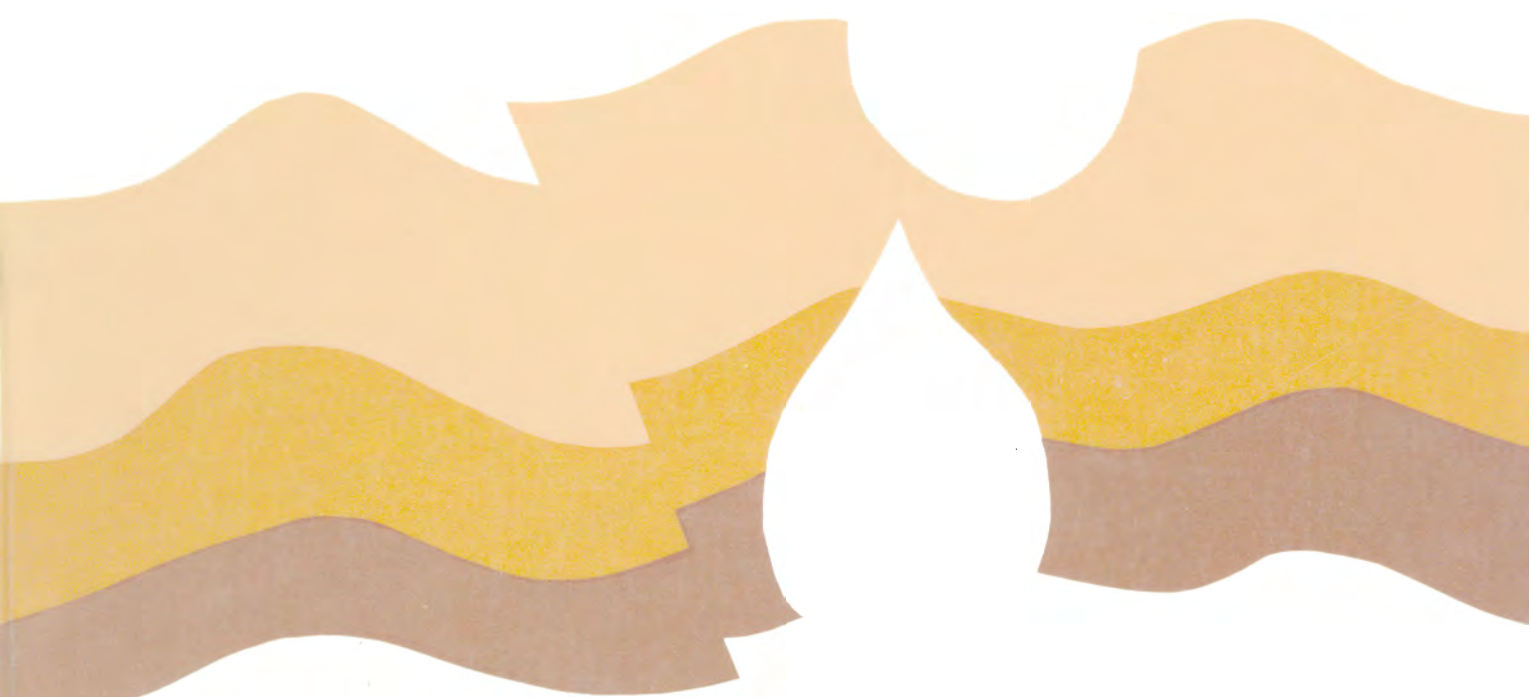


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THE HYDROGEOCHEMICAL ATLAS OF SRI LANKA



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THE HYDROGEOCHEMICAL ATLAS OF SRI LANKA

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SRI LANKA



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FOREWORD

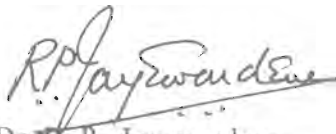
Since water is a precious natural resource its conservation and proper management are extremely important. If this is to be done efficiently continuous monitoring over all parts of the country must be undertaken.

The hydrogeochemical atlas fills a long standing gap in the geological field. Groundwater monitoring is essential. The knowledge so gained will indicate where good water is available and also where pollution – natural or man made – is prevalent.

The atlas is the result of the work done by the Environmental Geochemistry Research Group of the Department of Geology, University of Peradeniya. The geochemistry of potable water in Sri Lanka has been an important area of the research undertaken by this group. The importance of this work is evident when we realize that water borne diseases are widespread in our country. These diseases are preventable. If our water resources are monitored and well managed these preventable diseases may ultimately be controlled.

Another important health hazard is the presence of large amounts of fluorine in the water. This has been found in the dry zone in the Eastern and North Central Region of the country. High concentration of fluorides in groundwater in these areas cause dental fluorosis (*tooth mottling*) especially in children living in those regions. The geochemical status of fluorine in the environment is extremely important in the study of this disease.

The Natural Resources, Energy and Science Authority (*NARESA*) has awarded a research grant to Prof. Dissanayake for this research work. I am extremely happy that NARESA is contributing towards this research effort and to the preparation of this atlas which will be of great help to all those working with groundwater resources.



Dr. R. P. Jayewardene

Director-General

Natural Resources, Energy & Science Authority

PREFACE

The need for clean water as one of the most essential commodities for mankind can never be over-emphasized. Groundwater monitoring is one of the most important aspects of management of groundwater resources and prevention of groundwater pollution. Resource conservation calls for comprehensive monitoring systems to protect groundwater resources from pollutants. Pollution, whether natural or man-induced, is not confined to industrialized nations and administrative boundaries. However, most environmental research activities have been centered on rivers, lakes and atmosphere in developed nations. Very few case studies have been reported from developing countries, and for this reason it is of interest to note the establishment of a Central Environmental Authority in Sri Lanka, and the active participation of many research organizations including the Environmental Geochemistry Research Group of the Department of Geology at the University of Peradeniya. This interdisciplinary work has, not surprisingly, revealed some unpleasant but hard truths. The geochemistry of potable waters of Sri Lanka is one important area of study, in view of the fact that the majority of the country's health problems are related to its aquatic environment. According to a government publication, only 10 – 15% of the people have access to piped water. The majority use small, unprotected wells, and in rural settlements, reservoirs and water channels are the main sources of drinking water. The proper disposal of human and other wastes through sewage systems and latrines is also severely limited, less than a third of the population having satisfactory latrine facilities. The poor water supply and excreta disposal systems have resulted in 40% of the Sri Lankan population being affected by typhoid, amoebic and bacillary dysentery, infectious hepatitis, gastro-enteritis, colitis and worm infections.

Our research group has recently carried out a preliminary Island-wide survey of nitrates in drinking water from wells, since an excess of nitrates can cause bowel diseases and methaemoglobinaemia in children. This study shows that some areas, such as Jaffna, do indeed have dangerous levels of nitrates above the W.H.O recommended limits of 50 to 100 mg/l. Other areas that contain high nitrate levels in well waters are the coastal regions around Batticaloa. The study also revealed that there are close correlations between the nitrate content in the water and factors such as population density, fertilizer use, annual rainfall and the underlying geology. At present, the research group is conducting a similar survey on the distribution of nitrosoamines, which are known to be carcinogenic and which could be formed by the reduction of nitrates and nitrites in the natural environment. In another study, the incidence of heart disease was related to the hardness of water in Sri Lanka. Studies conducted in other countries have shown that in most cases, people living in areas containing "hard water" are less prone to heart diseases than those living in areas containing "soft water". The results of this Island-wide survey showed that the same correlation also exists in Sri Lanka. Areas underlain by soft water have higher incidences of heart ailments, whereas these are less common in the Jaffna district which is underlain mostly by limestones yielding hard water. Such geomedical studies are proving to be of extreme importance, since potential health hazard regions can be easily delineated and studied in detail.

The water quality of recently constructed reservoirs in central Sri Lanka is also under investigation. In the Polgolla reservoir, for example, it was found that trace metal concentra-

tions exert an influence on the quality of drinking water of wells in the vicinity. This is particularly so for the case of Mn, which exceeds the W.H.O standard of 0.5 ppm by a factor of three.

One of the major objectives of our research group is the production of geochemical maps showing the distribution of elements or important chemical species in the surface and groundwater of Sri Lanka. A geochemical data bank is now being prepared with the assistance of the Water Supply and Drainage Board and the Water Resources Board of Sri Lanka. For example, in a preliminary survey carried out on the relationship between fluoride ions in drinking water and the incidence of dental diseases, areas with abundant fluoride concentrations in the water ($> 3 \text{ ppm}$) were identified. Dental fluorosis was found to be common in areas where mineral deposits such as apatite are found or where hot springs with exhalations of fluorine occur. In contrast, those areas with very little or no fluoride, such as the central region of Sri Lanka, had a high incidence of dental caries. The intensity of rainfall also plays a major role in the leaching of fluoride ions from soils and probably contributes to the formation of a low fluoride zone in the wet central region of Sri Lanka.

Relationships between the geochemical environment and human health are particularly complex and progress in establishing association and causation, between geochemical factors, health and disease requires rigorous interdisciplinary research. The production of a hydrogeochemical atlas has long been a national need for Sri Lanka. This atlas is the result of many years of work by us and it is hoped that this hydrogeochemical atlas would prove to be useful to hydrogeologists, agriculturists, town-planners and public health workers, epidemiologists and environmentalists of Sri Lanka.

Many friends and colleagues, particularly those in the Water Supply and Drainage Board, Water Resources Board and the Government Geological Survey Department have, in various ways helped in the preparation of the atlas, and to them we are deeply indebted. The extremely valuable assistance rendered by the academic and technical staff of the Department of Geology of the University of Peradeniya is gratefully acknowledged.

A special word of thanks is due to Dr. R.P. Jayewardene, Director-General of the Natural Resources, Energy and Science Authority of Sri Lanka for his very kind Foreword.

Finally I wish to thank Mr. Anil Ranasinghe and other staff members of the NARESA Printing Unit for technical assistance and excellent printing of this publication.

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*Department of Geology,
University of Peradeniya, 1985.*

1. THE PHYSICAL ENVIRONMENT OF SRI LANKA

Location and physiography

The Island of Sri Lanka is geologically and physically a southern continuation of India, only recently separated from the mainland by the shallow sea covering the Palk Strait and Gulf of Mannar. It is an essentially compact island, 69450 km² in extent lying off the southern tip of Peninsular India between latitudes 5° 55' – 9° 51' N and longitudes 79° 41' – 81° 53' E. It is separated from the Indian sub-continent by a strip of sea which, at its narrowest, is about 25 miles wide. The continental shelf is narrow around the southern part of the Island, but towards the north, it widens out and merges with the platform that surrounds India.

The morphology and morphotectonics of Sri Lanka have been studied by Adams (1929), Wadia (1945), Cook (1951) and Vitanage (1970). On the basis of height and slope characteristics, the Island can be divided into three main morphological regions (Vitanage, 1970).

1. The coastal lowlands with elevation from sea level to 305 m with a few isolated inselbergs. The slopes in the coastal belt range from 0° to 15°. The striking feature of the lowlands is that they are very narrow, particularly in the southern margin of the Island where the width could be as small as 3.2 km. Towards the west however, the coastal lowlands become wider with the widest parts being seen in the north west (*fig. 1*).
2. The uplands with elevations ranging from 305 m to 915 m consisting of ridge and valley topography and highly dissected plateaus. These areas comprise of narrow "arenas" or "amphitheatres" and domes occupying nearly three tenths of the Island. The average degree of slope varies from 10° to 35° along the upland ridges depending on the lithology and structure.
3. The highlands comprising of a series of well defined high plains and plateaus rimmed with mountain peaks and ridges. Their elevations range from 915 m to 2420 m and these highlands characterise the central parts of Sri Lanka. These morphological features are not continuous and are separated from the intervening dissected lower plateaus and uplands by steep escarpments and deep valleys. Two distinct highland mountain massifs – knuckles Massif (2035 m), north east of Kandy and Rakwana Massif (1488 m) south west of Sri Lanka occur detached from the main central highland area proper by the deeply eroded valleys carved out by the head streams of the Mahaweli and Kelani rivers.

Climate

The climate of Sri Lanka is basically controlled by its location within the tropics, its proximity to the Indian sub-continent, its insularity and the presence within it of a centrally

located mountain mass (*Peiris, 1976*). The tropical location of Sri Lanka ensures a uniformly high temperature, but maritime influences consequent upon its insularity makes it free from thermal extremes that are characteristic of continental interiors. The mean monthly temperatures in the lowlands of Sri Lanka fall between 78° – 85° F with little seasonal and moderate diurnal variations. In the central highlands however, there is an orographically induced lowering of temperature to monthly means that range from 55° – 70° F, in the highest parts of the country. In the absence of marked thermal differences, rainfall becomes the conspicuous parameter in the seasonal and spatial variations in climate (*Peiris, 1976*).

The average annual rainfall in Sri Lanka ranges from around 80 cm to 500 cm. Nearly two thirds of the country receive less than 200 cm of rainfall annually. The southwest and the centre experience more than 200 cm with the higher amounts reaching as much as 400 cm – 500 cm. These very high rainfall areas are confined to a small area in the southwestern slope in the central hill country and Knuckles range in the northeastern sector of the hill country. The lowest annual rainfall of less than 100 cm is found in the extreme northern, north-western and southeastern areas.

According to the spatial and regional distribution of rainfall, Sri Lanka has traditionally been divided mainly into two zones, the wet and dry zones. Further, in certain areas of the central highlands such as the 'Uva Basin', a transitional zone with its own climatic peculiarities has been discerned (*Domros, 1966*). Hence the border areas between the major wet zone and dry zone boundaries are recognized as the intermediate zone. Of Sri Lanka's total land area, approximately 65% falls into the dry zone whereas the wet and the intermediate zones are recognized as constituting 23% and 12% respectively.

The geology of Sri Lanka

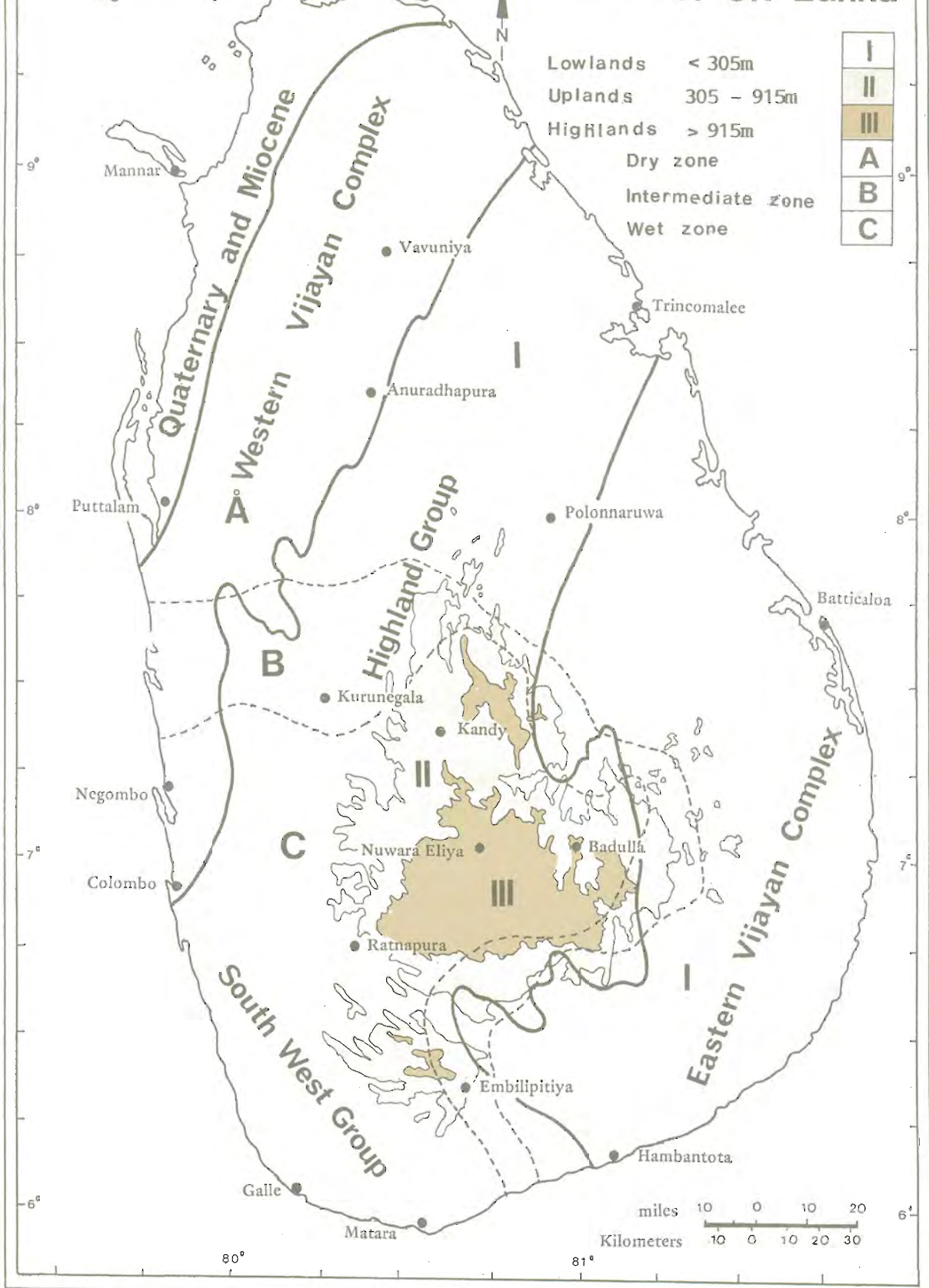
Nine tenths of Sri Lanka consists of Precambrian metamorphic rocks metamorphosed under granulite and amphibolite facies conditions. The rest, mainly in the northwestern part is covered by Jurassic, Miocene and Holocene sedimentary formations. The Precambrian metamorphic complex of Sri Lanka is generally subdivided into three main groups.

1. **The Highland Group (*Highland Series*)**
Geographically it occupies a broad belt running across the centre of the Island from southwest to northeast. The major rock types found in this area are charnockites, quartzites, marbles, gneisses and granulites.
2. **The Vijayan Complex**
The Vijayan Complex occupies the lowlands of Sri Lanka on the northwest and eastern part of the central Highland Group belt. This complex consists of microcline biotite gneisses, hornblende gneisses, migmatites and granites formed under almandine amphibolite facies.
3. **The Southwest Group**
The rocks of this group are metamorphosed under cordierite granulite facies conditions and consist of the rocks, cordierite gneisses, charnockites, garnetiferous gneisses, wollastonites and calc silicates etc.

The interrelationships of these divisions have long been a controversy in the geology of Sri Lanka. The earliest view on these metamorphic rocks was that the Vijayan Complex was

Fig.1

Climatic, Physiographic and major Geological Divisions of Sri Lanka



a basement to the Highland Group of rocks (*Coates, 1935; Wadia, 1943, Fernando, 1948*). *Vitanage (1970, 1972)* on the otherhand, believed that the Vijayan rocks are of the supracrustal type whereas others (*Cooray, 1967, 1978; Berger, 1973; Berger and Jayasinghe, 1976*) likewise believed in a younger Vijayan that had been formed by retrogressive metamorphism of the pre-existing Highland Group rocks. *Katz (1971)* started the major controversy by reverting to the older idea of a Vijayan basement overlain by supracrustal metasediments of the Highland and Southwest Groups. This was severely criticized by *Berger (1973)* and followed by *Berger and Jayasinghe (1976)* and *Cooray (1978)*.

A major dimension was added to this controversy by *Munasinghe and Dissanayake (1979, 1980a, 1980b)* when they applied modern views on plate tectonics to Sri Lanka and concluded that the Highland - eastern Vijayan boundary is a possible mineralized belt and a convergent plate boundary and believed in a Vijayan basement. *Cooray and Berger (1980)* criticised this view calling it a startling proposition. *Munasinghe and Dissanayake (1980c, 1982)* elaborated their views further and outlined a plate tectonic model for the geologic evolution of Sri Lanka. The Rb/Sr age data of *Crawford and Oliver (1969)* unfortunately do not shed much light on the problem and fresh data with good sampling are clearly required.

The structure of Sri Lanka

The Precambrian rocks which comprise the Highland Group have been thrown into a series of anticlinal and synclinal structures, canoe shaped basins and elongated domes which form a broad north plunging "synclinorium" occupying the centre of the Island from Galle to Trincomalee. The open, gently flexured and folded metasedimentary rocks and thick charnockite bands which underlie the high plains around Nuwara Eliya show a gradual plunge towards the northwest. These give rise to a very striking series of doubly-plunging synclinal and anticlinal structures, and can easily be identified by their typical arena and amphitheatre-like depressions. The greatest development of these arenas is around Kandy, where a series of elongated oval and canoe shaped arena structures 3 to 10 km across and 10-20 km in length have been observed (*Vitanage, 1972*). Three dominant structural trends can be recognized in the well developed strike ridges of the Highland Group of Sri Lanka.

1. NW-SE to NNW-SSE trends which have been termed as Taprobanian trends (*Coomaraswamy, 1906*) in the southwest sector, with a northward plunge of the fold axes.
2. N-S to NE-SW trends in the north and northeast.
3. A sharp E-W and NE-SW swing of the fold axes in the southwest in the upland and highland areas around Morawaka, Rakwana, Haputale and Nuwara Eliya.

The structural trends of the Vijayan rocks are also more varied and more irregular than those of the Highland Group of rocks. Strong dome-like and arcuate structures suggesting salt-dome tectonics are locally developed.

2. SAMPLING PROCEDURES

500 water samples were collected from dug wells from all topographic sheets (1:63360 scale) covering the entire Island. The average sampling density for a topographic sheet was 16 ± 5 . Due to problems caused by inaccessibility, only a limited number of samples could be taken from areas covered by the northern province of Sri Lanka.

The sampling locations were subsequently plotted on a 1 : 506880 scale map of Sri Lanka. This procedure was followed throughout this islandwide hydrogeochemical survey. In many parts of Sri Lanka, the dug wells sampled had a diameter of 1 to 3.5 m and depending upon the water table, these water wells in some cases could be as deep as 30 m. Approximately 60% of the studied wells are commonly used for drinking as well as for other domestic purposes. The protected wells usually have a watertight cement lining that extends for a distance of 3 to 6 m below the surface. This prevents the entry of contaminated groundwater into the wells. Further, these wells have a 1 to 1.5 m high head wall and a drainage apron so that any surface water and/or spillage cannot gain entry into the well. Only 10% of these protected wells used a hand pump for water abstraction thus permitting the use of a fixed cover which further reduces the risk of contamination. Nearly 55 – 60% of the wells studied do not belong to this category and are thus grouped as “unprotected wells”. The majority of these wells are found in the wet zone in Sri Lanka. In contrast, the wells in the dry zone of Sri Lanka usually experience salt water intrusion as a result of which some wells, as in the Hambantota area, are no longer in use by the community. The majority of the wells sampled, were 5 to 10 years old and were contaminated with debris, decaying plant material etc.

The discharge of human excreta in the form of soakage pit/septic tank effluents directly underground particularly in densely populated urban areas is very common. In some cases, particularly, in the Jaffna Peninsula, due to limitations of available land, the distance between soakage pits and water wells is small, in some cases as low as 6 m. In certain areas of the central uplands (eg: *Kendagolla, Welimada*) despite a rather large distance ($\sim 31m$) between the wells and the soakage pits, the water quality often tends to deteriorate due to faecal pollution. This is clearly seen in cases where the water well is located downhill from the pit latrine.

This hydrogeochemical survey was carried out after the rainy season in 1982/83 so as to avoid any discrepancies caused by seasonal fluctuations. The majority of the sampling sites were located close to motorable roads and foot paths.

Methods of sample collection and storage

The reliability of data on the chemical composition of water is affected by each of the three steps involved in its acquisitions, ie. sample collection, storage and analysis. The collection

and preservation of a representative sample of a natural water body, is the first and most important task for the determination of any substance in water. If the sampling procedure or preservation procedure is faulty, then the entire determination will be of doubtful validity at best. It is therefore important that each step of the collection and storage of a sample be carried out with great care.

The sampling bottles, collecting apparatus, etc. were cleaned before the collection of water by soaking overnight in 2–5N HCl and rinsed several times with distilled water of purity appropriate to the nature and levels of the analyses to be made. These sampling bottles were further rinsed with the water to be sampled before the final collection for analysis.

Four samples were taken from each sampling site for the following measurements.

| | | |
|--------|---|---|
| Sample | 1 | HCO_3^- |
| Sample | 2 | TDS, Cl^- , F^- , SO_4^{2-} |
| Sample | 3 | NO_3^- , NO_2^- and NH_4^+ |
| Sample | 4 | Fe, Mn, Cu, Co, Cr, Zn, V, total hardness ($\text{Ca} + \text{Mg}$), SiO_2 , Na, K. |

A 100 ml of settled, unfiltered water sample (*Sample 1*) was collected for the determination of HCO_3^- . A separate 1000 ml of well-mixed, filtered and unacidified water sample (*sample 2*) was collected for the determination of TDS, Cl^- and F^- . 2 mls of analytical grade CHCl_3 were added to 500 ml of the filtered water sample (*sample 3*), in order to retard the microbiological activity that may affect the analytical accuracy of the NO_3^- , NO_2^- and NH_4^+ determinations. A separate sample (*sample 4*) was acidified with analytical grade conc. HNO_3 until a pH of less than 2 was recorded. This minimises analytical inaccuracies caused by adsorption/ion-exchange with container walls. Every effort was made to analyse the water samples within 24 hours after collection. The samples were refrigerated at $0^\circ - 4^\circ \text{C}$ and kept in the dark until the chemical analyses were carried out in the laboratory.

3. ANALYTICAL TECHNIQUES

An understanding of the significance of water quality in water management requires information which can be provided only by a multidisciplinary approach with analytical chemistry playing a major part. Data on the effects of a wide range of lithogenic and anthropogenic substances on all forms of water — from industrial use to maintenance of ecological systems are often required. To acquire such data, the analytical chemist faces a continuing pressure to determine the form or reactivity of these substances. This involves, adaptation of existing techniques and development of new techniques for water sampling, preservation and analysis.

Determination of total dissolved solids in water

In the gravimetric determination of total dissolved solids (TDS) in water, a volume of sample containing 10 — 200 mg TDS is taken into a Pt dish and evaporated to dryness on a steam bath. The residue is dried at 180°C for 2 hrs, cooled in a dessicator and weighed to the nearest 0.0001 g using an electronic balance. (*Brown et al 1970*).

Determination of chloride content in water

The analysis of water samples include the determination of chloride by precipitation with a silver ion standard solution (1 ml = 0.50 mg Cl) using potassium chromate as an indicator (*Kolthoff and Sandell, 1952*). The pH of the sample is adjusted to 7.00 — 10.00 prior to the titration. The interference of sulphides and sulphates is eliminated by the use of hydrogen peroxide.

Determination of bicarbonate/alkalinity contents in water

The water sample is electrometrically titrated against standard 0.01 M H_2SO_4 acid while the pH was monitored throughout; the point of inflection of the titration curve in the region of pH 4.50 is taken as the end point (*Cook and Miles, 1980*).

Determination of nitrate and fluoride contents in water

(i) Determination of nitrate

The nitrate determinations are carried out using an Orion NO_3^- ion specific electrode (*Model no. 93 - 07*)/double junction reference electrode (*Model No. 90-02*). The sample of 10 ml is diluted to 1 : 1 v/v ratio with a buffer solution (dissolve 6.66 g of $Al_2(SO_4)_3 \cdot 18H_2O$, 3.12 g Ag_2SO_4 , 1.2 g H_3BO_3 and 1.94 g sulfamic acid (H_2NSO_3H), in

about 400 ml water. The pH of this solution is adjusted to pH 3.00 by 0.01N NaOH and diluted to 100 ml and stirred for 2 – 3 minutes. The electrodes are immersed in the sample and direct concentration measurements carried out with the Orion specific ion meter (*Model No. 404*) after 1 minute. As the slope of the curve (*mV versus concentration*) is not constant below 2 to 3 ppm (*Oien and Selmer-Olsen, 1969*) the nitrate content cannot be read directly from the meter. A standard graph is therefore drawn, for the lower concentrations. To obtain accurate results, the electrode is recalibrated hourly for dilute samples.

(ii) Determination fluoride ions

In the determination of fluoride ions using an Orion fluoride ion electrode (*Model no. 94-09-00*) and single junction reference electrode (*Model No. 90-01*), the sample is diluted with an equal volume of (*TISAB*) total ionic strength adjusted buffer (*57 ml glacial acetic acid, 58 g NaCl, 4 g di-sodium cyclohexylene dinitrotetraacetic acid, made upto 1 L with deionized water and the pH adjusted to between 5.00 and 5.55 with 5M NaOH*). The diluted sample is continuously stirred using an electromagnetic stirrer, and the electrode potential measured using an expanded mV scale Pye pH meter (*Model 291 MK 2*). Readings are taken when there is no change in the potential for a period of 10 minutes. Very good precision and accuracy have been obtained in the use of this electrode.

Determination of nitrite, ammonia, total silica, total vanadium and sulphate contents in water

(i) Nitrite determination

Nitrite is diazotized with sulphanilamide and the resulting diazonium complex is coupled with N-(1-naphthyl)- ethylenediamine to yield a reddish-purple azo dye, the absorbance of which is measured spectrophotometrically at 535 nm (*Henrikson, 1965*).

(ii) Ammonia and nitrogen determination

The water sample is first buffered with sodium borate to a pH of 9.50 to minimise hydrolysis of organic nitrogen compounds. Ammonia is distilled from the buffered solution, an aliquot of which is nesslerized. The concentrations of ammonia are determined spectrophotometrically at 425 nm (*Brown et al, 1970*).

(iii) Total silica

The total silica contents in the water sample react with ammonium molybdate in an acid medium to form the yellow coloured silicomolybdate complex which may form in water as the alpha and beta polymorphs. In order to favour the development of the beta form, the pH of the reaction is reduced to below 2.50 (*Govett, 1961*). The silicomolybdate complex is then reduced by sodium sulphite to form the molybdate blue colour. The absorbance of the resultant solution is measured spectrophotometrically at 810 nm. The interference effect of phosphate ions is suppressed by the addition of tartaric acid. $\text{Na}_2\text{-EDTA}$ is added to eliminate any interference from Ca^{2+} and Fe^{2+} ions.

(iv) Total Vanadium

The concentration of trace amounts of vanadium in water is determined spectrophotometrically at 415 nm by measuring the catalytic effect it exerts on the rate of oxidation of gallic acid by persulphate in acid solution (*Brown et al, 1970*). Under the specific conditions of reactions, temperature and reaction time, the extent of oxidation of gallic acid is proportional to the concentration of vanadium. Interferences from chloride and bromide ions are reduced or eliminated by the addition of mercuric nitrate. Due to the high sensitivity of the method, other interfering substances which occur in concentrations only slightly above the tolerance limits are rendered harmless by dilution (*Fishman and Skougstad, 1964*).

(v) Sulphate

Sulphate ions are precipitated in a HCl medium with BaCl_2 so as to form BaSO_4 crystals of uniform size. The absorbance of the suspension solution is measured spectrophotometrically at 420 nm (*Rossum and Villarauz, 1961*).

Determination of Na, K, Ca, Mg, Fe, Mn, Cu, Co, Zn and Cr in water

(i) Determination of Na, K, Ca, Mg, Fe and Mn

Owing to the extreme sensitivity of the atomic absorption spectrophotometric methods for the determination of Na, K, Ca, Mg, Fe and Mn, water samples are diluted to the optimum concentration range when high concentrations of these elements are present. The samples are directly aspirated into the air-acetylene flame and the concentrations measured directly and recorded using a Perkin-Elmer (*Model No. 2380*) atomic absorption spectrophotometer.

(ii) Total hardness

By definition, the hardness of water is a property attributable to the presence of alkali earths. Calcium and magnesium are the dominant alkali earth elements that are present in natural waters. Strontium and barium which are also alkaline earth elements are present in very low concentrations in all except the most unusual water systems. Thus the total hardness, in terms of CaCO_3 , of water samples is calculated using the following formula.

$$\text{Total hardness (ppm, CaCO}_3) = (\text{Ca} + \text{Mg}) \text{ in ppm} \times 50.05.$$

(iii) Determination of Cu, Co, Zn and Cr

Detection of copper (*Brown et al, 1970*), cobalt (*Fishman and Midgett, 1968*), zinc (*Rand et al, 1980*) and total chromium (*Brown et al, 1970*) are carried out by the solvent extraction method. In this preconcentration procedure, the element, is chelated with ammonium pyrrolidine dithiocarbamate (*APDC*) and extracted with methyl isobutyl ketone (*MIBK*). The optimum extraction efficiency of each element had been obtained by adjusting the pH of the solution either with 1N NaOH or 1N HCl as shown below.

| ELEMENT | pH RANGE |
|---------|--------------|
| Co | 2.00 – 10.00 |
| Cr | 3.00 – 9.00 |
| Cu | 0.10 – 8.00 |
| Zn | 2.00 – 6.00 |

This extraction/preconcentration procedure allows these metals to be concentrated by factors of 10 – 100 in the organic solvent, and further increases the sensitivity of the method. None of the soluble substances commonly present in natural waters interfere in this method.

Interferences

It has been noted (*Fishman and Downs, 1966*) that of the cations/anions present in water, only sodium interferes in the determination of K. This ionization interference is eliminated by matching standards to samples with respect to sodium. However, none of the cations/anions normally present in freshwater or sea water interferes in the sodium determination. The addition of 10 ml of La (58.65 g of La_2O_3 dissolved in 100 ml con. HCl and diluted to 1L with distilled water) to the 100 ml sample overcomes the chemical interference of sulphate, phosphate, aluminium or silica on the determination of Ca and Mg. (*Rand et al, 1980*). The interference of SiO_2 for iron determination is suppressed by the addition of 25 ml calcium solution (Dissolve 630 mg of $CaCO_3$ in 50 ml of HCl, boil gently and dilute to 100 ml with distilled water) to 100 ml of sample.

Accuracy and percision in analytical methods

Accuracy can be defined as the extent to which the analysis is capable of giving the 'true' value for any component. Precision is the extent to which the results of a given series of determinations are scattered about the mean value. The relative standard deviation and relative standard error are statistically preferred in quoting precision and accuracy of a method.

The analytical methods used in this survey are summarized in the following table. These methods have been checked in two other laboratories and the results compared. The detection limits listed are those which have been determined experimentally under the specific conditions. The precision data for the determination of TDS and alkalinity are not significant due to the great variation in sample characteristics in the determination of TDS and alkalinity.

SUMMARY OF ANALYTICAL METHODS

| Parameter | Method | Detection limit (ppb) | Normal working range | Relative standard deviation % | Relative standard error % | Reference |
|------------------|-------------------------|-----------------------|----------------------|-------------------------------|---------------------------|--------------------------------------|
| TDS | gravimetry | | less than 1000 ppm | | | Brown et al (1970) |
| Cl | titrimetry | 100 | 5 - 800 ppm | 4.00 | 1.80 | Kothoff and Sandell (1952) |
| HCO ₃ | titrimetry | 100 | 100 - 400 ppm | | | Cook and Miles (1980) |
| NO ₃ | selective ion electrode | 100 | 1 - 50 ppm | 1.50 | 1.00 | Orion research incooperated (1979) |
| F | selective ion electrode | 100 | 0.1 - 10 ppm | 0.20 | 4.80 | Orion research incooperated (1983) |
| NO ₂ | colorimetry | 20 | 0.1 - 4 ppm | 1.50 | 1.00 | Henrikson (1965) |
| NH ₄ | colorimetry | 10 | 0.1 - 2 ppm | 5.30 | 1.20 | Brown et al. (1970) |
| SiO ₂ | colorimetry | 20 | 1 - 100 ppm | 14.3 | 7.20 | Govett (1961) |
| V | colorimetry | 0.10 | 0.1 - 8 ppb | 20.0 | 0.00 | Brown et al (1970) |
| SO ₄ | turbidimetry | 1000 | 1 - 100 ppm | 9.10 | 1.20 | Rossum and Villarauz (1961) |
| Na | AAS | 20 | 0.25 - 400 ppm | 3.20 | 0.10 | Operation manual Perkin Elmer (1982) |
| K | AAS | 40 | 0.50 - 5 ppm | 4.00 | 0.30 | -do- |
| Ca | AAS | 100 | 5 - 40 ppm | 3.70 | 4.30 | -do- |
| Mg | AAS | 50 | 1 - 50 ppm | 10.7 | 0.70 | -do- |
| Fe | AAS | 50 | 0.10 - 1 ppm | 10.0 | 4.30 | -do- |
| Mn | AAS | 50 | 1 - 500 ppb | 12.0 | 2.00 | -do- |
| Cu | solvent extraction/AAS | 1 | 1 - 10 ppb | 12.7 | 12.0 | Brown et al (1970) / -do- |
| Co | solvent extraction/AAS | 1 | 1 - 20 ppb | 13.6 | 10.0 | Fishman and Midgett (1958) / -do- |
| Cr | solvent extraction/AAS | 1 | 1 - 25 ppb | 7.80 | 4.30 | Brown et al (1970) / -do- |
| Zn | AAS | 10 | 10 - 200 ppb | 7.20 | 0.50 | Rand et al (1980) / -do- |

AAS : Atomic Absorption Spectrophotometry.

4. PLOTTING OF DATA AND MAP MAKING

Sampling method and smoothing out techniques

As the object is to secure a sample which will reproduce the characteristics of the total population as closely as possible, the main requirement is to avoid bias in the selection of sampling data. A random sample of 465 was chosen with the help of a standard random number table (*Dalton et al, 1975*) for the classification and for the illustration of the spatial variations of groundwater chemistry in Sri Lanka. However, there would still be the sampling error due to chance differences between the members of the population included in the sample and those not included.

These local irregularities of sampling results often obscure rather than clarify any attempt to extract diagnostic patterns in the production of contour maps at regional scale (*eg. 1 : 250,000*). These observed irregularities must be harmonized first with suitable smoothing out procedures. Much of the studies in this direction had been carried out by *Olea (1975)* and *Davis (1973)*.

In preparing the contour maps for 15 water quality parameters in Sri Lanka the following method was used to process the available data.

The concentration values of each parameter to be contoured was placed separately on a 1 : 1192660 scale map of Sri Lanka which was previously divided into 145 square grids of 4 cm² (~ 554 km²) each such that each square contains a number of sampling locations. The average value of the concentration of each parameter in each square was assigned to the respective grid node. This procedure eliminates the spurious values of the observed results to a great extent. It should be noted that the processed data is located at regular intervals rather than at irregularly spaced actual observations. These smoothed values were then placed in a frequency table from which it was possible to obtain a frequency distribution curve to identify the number of groups of each population studied. These group interval boundaries are subsequently used as the contour intervals in producing the hydrogeochemical map of Sri Lanka.

The classification of groundwater

The Piper diagram (*Piper, 1944*) is a multiple trilinear diagram for graphic representation of the major chemical constituents – namely Ca, Mg, Na, K, HCO_3^- , CO_3^{2-} , SO_4^{2-} and Cl^- – of water, and effectively portrays analytical data. Similar graphic techniques were developed by *Hill (1942)* *Langelier and Ludwig (1942)* and *Romani (1981)*. The model used in this study is a modification by *Hem (1970)*.

In addition to this graphic illustration of major constituents in water, a fairly recent and promising modification of the Piper diagram involves the use of component cation and anion diagrams to classify water. The water type is generally named after the dominant cations and dominant anions – defined as constituting more than 50% of the cation or anion. This has been accomplished graphically by joining the mid points of each side of each triangular field, which divides each triangular diagram into 4 smaller triangles. Thus a water type is easily named, based on the positioning of the points in the cation and anion triangles. Unless there are non-dominant cations or anions, the water type is named after the cations (*Ca, Mg, Na/K*) followed by a hyphen and a similar term selected for anion possibilities (*SO₄, Cl, HCO₃/CO₃*). When a water type plots in the Piper diagram in the non-dominant cation or non-dominant anion fields, it indicates that on percentage epm basis, no ion is present in an amount greater than 50%. In such instances, non-dominant cation (*NDC*) or non-dominant anion (*NDA*) forms the descriptive name.

5. TOTAL DISSOLVED SOLIDS (TDS) (Map No. 1)

The composition of groundwater naturally reflects the underlying geology, the residence time in the rock, the previous composition of the groundwater and in some instances, the flow path. Due to the slower movement of groundwater as compared to that of surface water, the composition of the former shows a negligible variation with time for a given aquifer. The concentration of dissolved constituents in the groundwater however, may vary widely – sometimes several fold – in different aquifers.

The physical and chemical properties of water are mainly dependent on the total dissolved solids (TDS) content. Water containing more than 1000 ppm of TDS (WHO, 1982) is generally not recommended for drinking purposes. The following table shows the total dissolved contents of water and the degree of salinity.

| TDS (in ppm) | Degree of salinity |
|---------------|--------------------|
| 1000 – 3,000 | Slightly saline |
| 3000 – 10,000 | Moderately saline |
| 10000– 35,000 | Very saline |
| > 35,000 | brine |

In irrigation practices, the TDS content in water is an extremely important water quality consideration. The water uptake relation of plants is mainly controlled by the osmotic pressure differential between soil solution and plant solution. This osmotic effect is generally related to the total concentration of TDS rather than to the individual concentration of specific ionic constituents.

As shown in map 1 the total dissolved solid concentrations range widely in the groundwater of Sri Lanka. In much of the inland areas, TDS range from 100 to 600 ppm, and water of this type can be considered as fresh water. The relatively low amounts of total dissolved solids (eg. less than 200 ppm) in the waters of Kandy, Nuwara Eliya and Badulla suggest a lack of soluble material in the soil or a rapid flow rate or both.

Distribution of TDS in the Northern Region of Sri Lanka

In the northern coastal region of the Island, at least a part of the Jaffna peninsular limestone aquifer is subjected to salt intrusion. The TDS content ranges from about 1200 to 1900 ppm, due to the presence of large quantities of Na and Cl. In extreme cases, these values tend to increase up to 30000 ppm, nearly to the same level as in sea water. In this work, the surface expressed by the 1900 ppm line of equal TDS concentration is defined as the salinity front.

A zone of transition exists between the salinity front and freshwater. In the zone of

transition (*TDS ranging from 500 to 1900 ppm*), the aquifer contains water which has concentrations predominantly intermediate between those of freshwater and saline water. In the Southern coastal regions of the Island however, intermixing of freshwater and saline water is not marked, probably due to the higher rainfall in some parts and discharge of freshwater towards the sea in contrast to the converse in the Jaffna Peninsula. The only exception appears to be an elongated region around Hambantota where total dissolved solids of upto 800 ppm are found. The zone of transition broadens from a width of about 20 km in the northeastern sector to about 160 km along a north-south direction. The principal mechanism for developing a zone of transition is the backward motion of the saline water resulting from tidal action and the rise and fall of the potentiometric surface due to variation in re-charge and other forces, including pumping. It should also be noted that during the past few hundred to thousand years, the Island has been subjected to multiple cycles of sea level fluctuations. The observed distribution of dissolved contents – especially in the northern region – may therefore reflect, in part, the effects of past sequences of intrusion and flushing of saltwater due to sea level changes.

The effect of the climate on the TDS contents of groundwater

Groundwater is generally considered as being of fairly stable chemical quality, even though the concentrations may vary. It would vary in response to climatic environments, including precipitation, evaporation, temperature, the nature of the hydrologic system of the region, etc. In the dry zone, high temperatures the year round promote high evaporation, which reduces the amount of water and which increases the TDS contents of the remaining water. The increase of TDS due to evaporation however, will be pronounced in groundwater at shallow depths. As a result of this, a general decreasing trend of TDS contents with rainfall is observed in the dry zone of Sri Lanka. In the wet zone however, the TDS concentration shows a marked decrease with increasing rainfall.

Relation of rock type to TDS contents in groundwater

The correlation of rock type with the chemical character of water is rarely simple or obvious and in Sri Lanka, it is further complicated by the diversity of lithology present. Water, from basic and ultrabasic rock-bearing terrains tend to have high TDS contents, whereas water from quartzites, marble etc. are low in TDS. Mafic minerals weather to readily soluble products whereas quartz and to a lesser extent feldspar, prove less tractable to the agents of chemical weathering. The TDS contents in water of charnockitic gneiss and biotite gneiss host rocks ranged from 200 to about 1200 ppm. Water from marble, quartzites and feldspathic rocks, on the otherhand contained TDS contents less than 200 ppm. Waters from wallostonite, scapolite type host rocks in the southwest of Sri Lanka are characterized by TDS contents of 200 to about 500 ppm. The limestone terrain of the northern sector yields water with more than 1900 ppm TDS. However, at very high TDS levels, the water chemistry is dominated by chloride ions.

6. TOTAL HARDNESS (Map No. 2)

Hardness is an important characteristic of water, related to the presence of alkaline earths. Ca and Mg are principal alkaline earth elements present in natural waters. Sr and Ba, which are also alkaline earth elements, are present in very low concentrations in all except the most unusual water systems. The ions of Fe, Mn and Al are normally not present in sufficient concentrations in natural waters to effect hardness. The term hardness is used in many ways, each with its own definition.

- eg. (1) Carbonate hardness : The amount of hardness chemically equivalent to the amount of HCO_3^- and CO_3^{2-} in solution.
- (2) Total hardness : Ca^{2+} plus Mg^{2+} hardness in solution.

Based on hardness, water can be classified as follows:

| Hardness in ppm as CaCO_3 | Classification |
|------------------------------------|-----------------|
| 0 – 60 | Soft |
| 61 – 120 | Moderately hard |
| 121 – 180 | Hard |
| > 180 | Very hard |

Map 2 shows the spatial distribution of hardness in groundwater in Sri Lanka. As shown in the map, concentrations of hardness display wide geological variations. High values (*i.e.* more than 850 ppm in CaCO_3) of total hardness occur frequently in the water of the northern sedimentary formation of Sri Lanka. In much of the inland and in the Vijayan Complex of the Island, hardness concentrations in general fall in the range of 250 – 500 ppm in CaCO_3 . Concentrations less than 250 ppm in CaCO_3 hardness are largely restricted to the Highland areas of Sri Lanka.

As shown in map No. 2 the Jaffna Peninsula has the highest water hardness in Sri Lanka, indicating a clear relationship between aquifer geology and groundwater chemistry. The well water from the red-brown earth soil in the dry zone of Sri Lanka is characterized by 250 – 500 ppm of CaCO_3 total hardness. These soils may be more enriched in Ca – rich materials than the wet zone. In the humid well drained wet zone of Sri Lanka, rainwater would selectively remove cations from weathered rocks and soils by leaching. On the other hand, in the dry zone, with its limited rainfall and restricted stream activity, the continued addition of rainwater would only change the chemical composition of shallow groundwater by dissolving the accumulated salts during water table fluctuations. Thus, the amount of precipitation brings about a net dilution of the constituents of groundwater in the wet zone and in the dry zone, the secondary minerals widely present in the unsaturated zone tend to dissolve thereby increasing the mineral content of the water.

7. NITRATES, NITRITES AND AMMONIUM IONS (Map. Nos. 3,4,5)

The study of nitrogenous compounds in groundwater and potable water systems has recently assumed extreme importance. The potential health implications of the contamination of drinking water by nitrates have attracted scientific attention since 1945, primarily in connection with methaemoglobinaemia. As Brooks and Cech (1979) have pointed out, attention is at present sharply focussed on the problem of the intake of excessive nitrates, as these compounds, on reduction, yield nitrites and secondary amines known to be carcinogenic (Magee and Barnes, 1967; Bogovski, 1972). Nitrites however, are unstable in the presence of oxygen and are therefore hardly present under aerobic conditions. The presence of nitrite in water is perhaps an indication of organic pollution.

Map 3 shows the distribution of nitrates in the well waters of Sri Lanka. In general, these average nitrate levels are below the danger level of 45 ppm as specified by the World Health Organization, with the Jaffna region being an exception. High nitrate levels are found in and around the main cities of Sri Lanka indicating a possible relationship with the population density. This clearly shows the effect of human influence on the input and distribution of nitrogenous species in the groundwater regime.

The influence of climate on nitrate contents

A feature worthy of note is the influence of the climate on the levels of nitrates in the groundwater of Sri Lanka. As shown in map 3, most of the wet zone of Sri Lanka has greater nitrate levels than the dry zone. The rainfall influences the distribution of nitrates in the groundwater by raising or lowering the groundwater table. In the wet zone of Sri Lanka, the water table as expected is shallow, and hence easy migration of the nitrates from the top soil into the relatively shallow water table results in a high nitrate content. In the dry zone of Sri Lanka however, the water table is deep and in spite of a high fertilizer input into the soil, the groundwater contains very low nitrates mainly due to the problems associated with the migration of the nitrogenous species deep in the water table. The effect of atmospheric electric discharges on nitrogen fixation and NO_3^- production in the wet zone is also of great importance.

Nitrates in the Jaffna Peninsula

As shown in map 3 the Jaffna Peninsula has the highest nitrate contents in the groundwater of Sri Lanka. Geologically, the Jaffna Peninsula is underlain by highly fractured and karstified limestone of Miocene age. There is a thin soil mantle of the red/yellow latosol type and in the southern part of the Peninsula are 10 – 20 m of fine sand which overlie the limestone formation.

According to Gunasekeram (1983) 80% of the groundwater of the Jaffna Peninsula is being extracted from the limestone aquifer. The water table in the Jaffna Peninsula is very shallow on account of the surface aquifers. Gunasekeram (1983) in his detailed study of the groundwater contamination in the Jaffna Peninsula found that 80% of the water wells yielded water of unacceptable bacteriological quality contaminated with faecal coliform. Among the major factors responsible for the poor water quality in the Jaffna Peninsula are:

1. Discharge of human excreta in the form of soakage pit/septic tank effluents directly underground within densely populated urban areas. In some cases, due to limitations of available land, the distance between soakage pit and water well is only 6 m.
2. Abundant use of agricultural fertilizers, mainly urea which contains 46% N. Excessive use of urea on crops such as chillies and onions is prevalent. In addition, cattle manure is commonly used.
3. The easy solubility of urea enables it to reach the very shallow groundwater table and under normal conditions about 75% of the nitrates applied, reach the groundwater and percolates.

The fact that in certain locations in the Jaffna Peninsula, the nitrate levels exceed W.H.O. limits by 100 – 150% is mainly due to the abundant nitrogenous waste matter in the form of human excreta and synthetic and animal fertilizer reaching the shallow groundwater table aided by the surface limestone aquifer. The geological conditions are therefore ideal for the excessive accumulation of nitrates.

The dangers associated with drinking water wells being placed very close to septic tanks have been highlighted in many case studies from other countries. Hutton and Lewis (1980) in their study of nitrate pollution of groundwater in Botswana found nitrate levels as high as 603 ppm in several water supplies providing drinking water to many villages. A lithium chloride tracer injected into a pit latrine was detected in the supply borehole 25 m away after only 235 mins. The steep hydraulic gradient between the latrine and the borehole had obviously induced the rapid movement of nitrates occurring in open fissures.

The case of Jaffna could even be worse bearing in mind the very short distance of 6 m from the pit latrines to the water well as observed in some cases.

Distribution of nitrites (*Map No. 4*)

Chemical analyses of water from wells in Sri Lanka indicate a wide range of concentrations of nitrite. Nitrite seldom appears in concentrations greater than 1 ppm. Even in waste water effluents and in fresh water, its concentration is well below 1 ppm (Sawyer and McCarthy, 1978). Out of the wells studied, 48% had nitrite contents of less than 0.05 ppm. Only 3% of the wells studied had nitrite concentrations greater than 0.60 ppm in the groundwater. In eastern and southeastern regions of Sri Lanka, nitrite concentrations of more than 0.60 ppm levels have been recorded. At Kurunegala and Ratnapura, nitrite concentrations of 0.30 ppm and 0.45 ppm respectively have been observed. The occurrence

of high nitrites in natural waters at shallow depths is likely to be caused by point-pollution as no other dominating factors affecting the spatial distribution of nitrites have been observed.

The fertilizers, human and animal sewage are usually enriched with high concentrations of nitrogenous compounds which may enter into a groundwater body as a result of infiltration. The conversion of ammonia to nitrate (*nitrification*) is brought about by highly specialized soil bacteria. Nitrification takes place in two steps. In the first step, ammonia is oxidized to nitrite followed by further oxidation to nitrate. The accumulation of high concentrations of nitrites in water is often attributed to inhibition of nitrification at the nitrite stage. The specific environmental factors involved with this mechanism appears to be very complex. Under controlled conditions however, the oxidation of nitrite to nitrate by nitrobacter is inhibited by cyanide and from spectroscopic studies it has been suggested that a cytochrome is also involved (*Hughes, 1975*). The migration of these nitrogenous species usually occur in several ways. Ammonium (NH_4^+) being positively charged gets attached to clay particles and clay humus in soils which are negatively charged. On the other hand, nitrates and nitrites are not complexed by soils and therefore are free to move and are leached and enter into the groundwater body.

Nitrite is usually present in small amounts in well drained neutral or slightly acidic soils. However, accumulation of nitrite in appreciable quantities is observed in calcareous soils. The alkaline pH in the soil is particularly favourable for nitrite accumulation.

The distribution, occurrence and prevalence of nitrites in the environment are of utmost importance since they may act as precursors of many carcinogenic compounds.

The formation of N – nitroso compounds by interaction of nitrite with substances susceptible to N – nitrosation has received much attention and substances forming carcinogenic N – nitroso compounds include secondary and tertiary amines. The distribution of ammonium ion contents in the groundwater of Sri Lanka is shown in map No. 5. Puttalam and Amparai areas contain the highest ammonium ion concentrations in the groundwater of Sri Lanka. Ammonium ions generally enter groundwater from the decomposition of nitrogenous organic matter (*eg. domestic sewage*) and from industrial effluents. Out of the wells studied, 74% had ammonium ion concentrations of less than 0.20 ppm. 3.6%, 10.6% and 7.4% of the wells studied had ammonium ion concentration ranges of 0.20 – 0.30 ppm, 0.30 – 0.50 ppm and 0.50 – 1.00 ppm respectively.

There is a marked correlation between the distribution of ammonium ions and the macro-climatic regions of Sri Lanka. The occurrence of large concentrations of ammonium ions is observed in the groundwater of the dry zone whereas in the wet zone only low ammonium ion concentrations were noted. It is of interest to note that this is almost a reverse of the climatic zonal distribution of nitrates. Although the extensive input of the ammonium fertilizers are high in the arable lands of the dry zone, the contents of ammonium ions leachable into the deep water table is very low and is severely limited by the scarcity of rainfall. On the otherhand, the extensive rainfall in the wet zone permits the easy migration of ammonium ions from the soils as a result of cation exchange. Apart from climatic features, others such as population density, landuse, application of fertilizers, etc. also govern the distribution of the ammonium ions in the groundwater.

8. CHLORIDE (Map No. 6)

Chlorine is the most abundant element in the hydrosphere, the ocean being considered as the dominant part of the hydrosphere. It is generally conservative and travels through the hydrological cycle with little involvement in redox reactions, adsorption or the life processes of plants and animals. The large variation of Cl with time probably indicates the intrusion of aquifers by sea water, contamination of groundwater or surface water with industrial and domestic wastes. Periodic determination of chloride ions is therefore useful in water quality monitoring.

The W. H. O. recommended limits are:

| | Cl ppm |
|-------------------|--------|
| Maximum limit | 600 |
| Recommended limit | 200 |
| Action level | 250 |

As shown in map 6, the groundwater of Sri Lanka is characterized by the occurrence of high Cl^- contents with widely differing concentrations among individual wells. The Cl^- concentrations range from less than 100 ppm to above 2000 ppm with 54% of the studied wells containing water with less than 100 ppm Cl^- . Approximately 3% of the wells had more than 2000 ppm of Cl^- .

The occurrence and behaviour of Cl in groundwater is not yet completely understood except where seawater is overlain by cavernous freshwater limestone aquifers as in the case of Jaffna Peninsula. The freshwater aquifers in this area could possibly receive an increment of Cl by slow upward movement of brine where a potentiometric gradient favours such a movement. In places where wells are heavily overdrawn, cones of mineralized water get mixed up with the freshwater. A special case of freshwater – salt water interface is found in the Vavuniya region where the rocks are highly permeable and fresh groundwater floats in lens shaped configurations owing to density differences. A high concentration of Cl in groundwater is also observed along the Mahaweli shear Zone in Trincomalee and Polonnaruwa. In general, water in many fault zones contains higher Cl^- and SO_4^{2-} concentrations compared to the water in areas outside fault zones. It is worthy of note that regional occurrences of Cl^- – bearing minerals such as scapolites have been reported away from Trincomalee along the mineralized belt (Jayawardena, 1983). Further, the formation of scapolite is also reported to be due to the passage of normal groundwater (rich in Cl) or thermal water through the host rock (Shaw, 1960). Thus the occurrence of high Cl water in the Mahaweli Shear Zone may well be due largely to mineralizing – perhaps a hydrothermal process.

As seen in map 6, the distribution of chloride in the groundwater of Sri Lanka correlates with the climatic boundaries. The 100 ppm isoline for example, nearly coincides with such a climatic boundary between the wet and dry zones. The existing information on Cl in

rocks does not suggest that weathering of rocks could supply the quantities of Cl normally found in the groundwater. However, the relatively high Cl level ($> 300 \text{ ppm}$) observed in the southwestern region could probably be explained by the process of hydrolysis of scapolite or other Cl^- - bearing minerals (*Frederickson, 1951*). In this process, the H^+ ions penetrate into the mineral lattice. At each penetration site the electrical neutrality of the molecule is destroyed and an atom of one of the mineral constituents is displaced to compensate for each entering H^+ . A parallel, but different, reaction takes place where Cl^- ions occupy exchange sites on minerals such as mica and hornblende. The OH^- ion displaces the adsorbed Cl^- ions releasing the latter to solution.

9. FLUORIDE (Map No. 7)

Compounds of fluorine are found in soil, water, food and in the human body in the form of chlorides. They are also present in sea water, in some supplies of drinking water and in mineral deposits such as fluorspars (CaF_2) or apatite. The environmental behaviour of fluoride is of great importance physiologically. Children are more susceptible to the effects of fluoride than adults in view of the fact that childrens' skeletal tissues are relatively free from fluorides and are therefore absorbed more readily. The intake of excessive quantities of fluoride (*more than 1.5 ppm F^-*) containing drinking water particularly during calcification, may cause discolouration of teeth of children. If the fluoride concentration in the drinking water is less than 0.5 ppm, the incidence of dental caries may be high.

As shown in map 7, the fluoride concentration ranges between 0.10 to 3.00 ppm. The low fluoride areas (*below 0.10 ppm*) are mainly situated in the wet zone, whereas fluoride-rich areas lie mainly in the dry zone. It is conceivable that in the wet zone, where the average rainfall exceeds 300 cm in certain instances, the leaching of soluble salts is high, due to the tendency for soluble ions to be leached and carried away in solution. Fluoride is known to be easily leached from primary and secondary minerals and soils under the effect of high rainfall (*Hawkes and Webb, 1962*). In the dry regions, on the other hand, evaporation tends to bring soluble ions upwards due to capillary action in soils. The composition of the rocks of the area concerned, particularly the easily leached constituents coupled with the climate, are the key factors in the geochemical distribution of elements in a tropical region. The abundance of fluoride in the rocks and the ease with which it is leached under the effect of groundwater have an important bearing on the abundance of fluoride in the areas concerned and hence the prevalence of dental diseases. It is apparent from Map 7, that the high fluoride concentrations lie in the eastern and north central regions of the country. The central hill country and the southwest coastal regions have relatively low fluoride concentrations.

It is of interest to note that the high – fluoride zone of Sri Lanka lies on a mineralized belt at the Highland – eastern Vijayan geological boundary. Munasinghe and Dissanayake (1982) in their plate tectonic model for the geologic evolution of Sri Lanka, suggested that the Highland–eastern Vijayan boundary is a mineralized belt and put forward a series of evidence to substantiate their theory. The discovery of a Cu – Fe deposit at Seruwila on this boundary provided further evidence to this theory. Fluorine being a volatile element is known to be abundant in such tectonic zones and are enriched in rocks found at such locations. Granites are generally rich in fluorine and such granites are found in abundance at the eastern Vijayan Complex.

Mineralogically, 30 – 90% of the fluorine in calc-alkaline granites is usually located in biotite with lesser amounts in hornblende, muscovite, quartz and in accessories. However, accessory minerals – apatite, sphene, fluorite, mirolite, pyrochlore, topaz, tourmaline, spodumene, cryolite, etc. – occasionally contribute more than 50% of the fluorine notably

in F -- rich magmatic and metasomatic roof zones.

Among the areas containing the highest fluoride concentrations in well water, the regions around Eppawala and Anuradhapura are prominent. Fluoride concentrations as high as 9 ppm have been reported from these areas.

It is a well established fact that the fluoride ion can take the place of the hydroxyl ion and that an equilibrium could be maintained. The substitution of fluoride for hydroxyl ion is to be expected from similarity of ionic radii and charges. Extensive research has been carried out on the fluoride-hydroxyl exchange in geological materials. The presence of higher concentrations of fluoride in water in areas bearing fluorine-rich rocks is therefore explained on the basis of $F^- \rightleftharpoons OH^-$ interchange between minerals and water. Apatite in particular is known to exhibit this interchange of fluoride and hydroxyl ions. Fluorapatite, $Ca_5(PO_4)_3F$ and hydroxyl apatite $Ca_5(PO_4)_3OH$ are isomorphic end-members in the apatite solid - solution series. Human and other animal teeth are composed principally of hydroxylapatite, whereas fossil shark teeth are composed principally of fluorapatite.

Geochemical basis for dental diseases

High concentrations of fluoride in groundwater supplies have been the cause of dental fluorosis (*tooth mottling*) among persons who have lived in these areas and have ingested the water as children. According to W.H.O. standards a concentration of 1.5 mg/l in the drinking water is considered to be detrimental to health. Lack of fluoride in the drinking water on the otherhand, results in dental caries. Since fluorides enter the body mainly from the drinking water supplies, the geochemical status of fluorine in a particular region or environment is of extreme importance in the study of the incidence of dental diseases in that region.

Tooth enamel is composed principally of crystalline hydroxylapatite when fluoride is absent in the water supply. However, when fluoride is present in the water supply, some of the ingested fluoride ions are incorporated into the apatite crystal lattice of tooth enamel during its formation causing the enamel to become harder and possibly discolour. The substitution of fluoride for hydroxyl ion proceeds since fluorapatite is more stable than hydroxylapatite under most conditions.

As noted by Zack (1980), fluoride substitution into tooth enamel is affected by thermodynamic activity and by the amount of fluoride complexes that form in the presence of certain other ions. The activity of fluoride decreases with increasing ionic strength of water, and fluoride complexes form more readily in heavily mineralized water than in dilute water. Zack (1980) made several important observations concerning the occurrence of dental fluorosis in areas of different levels of fluoride and total dissolved solids in the water supplies. As expected, where fluoride levels were relatively low, examples of tooth mottling were low and, where fluoride levels were high, the incidence of tooth mottling was high. However, where fluoride and total dissolved solids were both high, examples of dental fluorosis appeared to be low.

Fluoride ions can be exchanged for hydroxyl ions on tooth surfaces. However, for ion exchange to proceed, either fluoride ions must be abundant, or electrochemical requirements as described by Hem (1970) on tooth surfaces would have to be different than they actually are in order to speed up the exchange reaction. The principle of ion exchange is applied by dentists on tooth surfaces when topical fluoride treatment is prescribed against tooth decay. In areas where fluoride is low or non-existent in the water supply, a paste or a gel containing as much as 10% SnF₂ is often applied to the teeth of dental patients (*American Academy of Pedodontics, 1976*). If ionization is complete, the solution contains enough fluoride (75,000 mg/l) to vastly speed up the exchange rate of fluoride ions for hydroxyl ions. An effective, but temporary barrier against dental decay is established on tooth surfaces. Most evidence shows that ionic substitution by systemic fluorosis (*ingested and absorbed through the digestive system*) rather than by topical fluorosis (*ion exchange on the tooth surface*) is the principal process by which fluoride is incorporated into tooth enamel. Electrochemical requirements on tooth surfaces are not normally suitable for ion exchange to take place (*Zack, 1980*). The fact that fluoride ions are approximately the same size and have exactly the same ionic charge as hydroxyl ions suggests that systemic fluorosis is the principal mechanism by which tooth mottling occurs.

Defluoridation of Public Water Supplies

In view of the implications on dental health of children and the on set of skeletal fluorosis in adults, it is important that the optimum concentration of fluoride be present in public water supplies. In Sri Lanka however, due to the fact that the vast majority of people use untreated water from dug wells, the problem of fluoride excess or deficiency may not be easily overcome. Defluoridation is generally more difficult than the removal of other ions, such as Ca or Fe, but Maier (1970) states that there are presently three methods that have proved to be practicable under varying conditions of raw-water quality and availability of treatment chemicals. The methods involve the use of activated alumina, bone char or magnesium compounds.

Uptake of fluoride by serpentine

Serpentine, a hydroxyl magnesium silicate has the remarkable ability to take up fluoride from an aqueous solution. This material has been employed with considerable success in the defluoridation of natural water (*Rao et. al. 1972, 1975*). Fluoride uptake by serpentine depends on a number of parameters, viz. chemical composition of serpentine, its particle size, pH of the medium and time of contact. Rao et. al. (1975) presented excellent data indicating the existence of an equilibrium between the fluoride concentrations in the solution and that taken up by serpentine over a wide range of experimental conditions. The available evidence strongly suggests the proxy of F⁻ for (OH)⁻ group as contributing to the principal mechanism of the process. The readers are referred to the papers of Rao et. al. (1972; 1975) for details.

The use of serpentine in defluoridating public water supplies is of considerable interest to Sri Lanka in view of the fact that serpentine deposits are abundant in Sri Lanka.

Use of the seeds of clearing nut (*Bot: Strychnos potatorum linn. Loganiaceae*)

(*Sinh: Ingini eta.*)

These seeds have often been used by villagers to purify water. Even muddy water is known to settle down rapidly when placed in pots the inside of which have been rubbed with the seeds. The effect of adding these seeds in the defluoridation of water needs to be carefully investigated as this may provide a cheaper method of defluoridation that is acceptable to the rural folk.

10. TOTAL DISSOLVED SILICA (Map No. 8)

Silicon constitutes about 20% (*atomic*) of the earths' crust, and is invariably associated with oxygen as SiO_2 and in silicate rocks, minerals and constituents. The transport of silicon and its intimate association with living organisms must involve solubilisation of the massive forms of silica and silicate, a process requiring their depolymerisation. When silica or silicates are in contact with water, there is invariably some hydrolysis of Si-O-Si bonds and silicic acid is liberated in very small quantities into the aqueous phase. At neutral pH, the solubility of silicic acid is of the order of 100 ppm and at concentrations below this it exists as a monomer $\text{Si}(\text{OH})_4$. At concentrations much above 100 ppm, monomeric silicic acid tends to polymerize, eventually forming colloidal silica.

Map No. 8 shows the distribution of silica in the groundwater of Sri Lanka. The clay mineral provinces as described by Herath (1975) closely follow the concentration of silica in groundwater of the Island and this feature points to the fact that the formation of clays have played an important role in the geochemical transformations of silica in the aqueous phase. It has been observed that silica concentration decreases exponentially in kaolinitic regions whereas it increases towards montmorillonite regions. A relatively constant concentration of silica in solution suggests a steady state of kaolinite \rightleftharpoons montmorillonite equilibrium. This phenomenon is well seen in the intermediate climatic zone of Sri Lanka. It has been observed that the silica content varies positively with annual rainfall in the wet zone and negatively in the dry zone. In the wet zone as the water table is shallow, the secondary silica, found in between soil particles easily migrates into the groundwater. The low values of pH-pK and p $\text{Si}(\text{OH})_4$ in the wet zone favour the exhaustive leaching of acid soils. However, in the dry zone, due to the deeper water table, most silicon found in the groundwater is probably derived from the decomposition or metamorphism of silicate minerals.

11. IRON AND MANGANESE (Map Nos. 9, 10)

It has been noted for nearly a century that trace elements exert a positive or negative influence on biological processes. However, it is only recently that great emphasis has been placed on the study of the behaviour of these elements in aquatic environments.

The term 'trace element' is rather ill defined. It is used nowadays to explain the presence of elements occurring in minute quantities in the environment. In addition, other terms such as 'heavy metals', 'trace inorganics', 'trace metals', 'micro elements', and 'micro-nutrients' are used synonymously with the term 'trace elements'.

Iron and manganese compounds are of particular importance since they are redox sensitive elements in the environment, and can act as potential sinks for other trace elements. The sorption and co-precipitation phenomena of transition metals by colloidal compounds of iron and manganese are largely controlled by the pH and Eh of the media. Apart from those redox sensitive reactions of iron and manganese, organic matter, chiefly humic and fulvic acids may exert a positive influence on the complexation of Fe and Mn in water.

In the aquatic phase, the essentially soluble forms of Fe and Mn are Fe^{2+} and Mn^{2+} which can occur largely under anoxic conditions. It has been shown that Mn^{4+} and Fe^{3+} are the only oxidation states possible for iron and manganese respectively in oxygen containing waters. These forms can be reduced to the soluble Fe^{2+} and Mn^{2+} ions only under anoxic conditions. Further, the oxidation of Mn^{2+} and Fe^{2+} may also be catalyzed by a wide range of micro-organisms.

The occurrence of relatively high concentrations of Fe and Mn in the groundwater of Sri Lanka is a wide-spread problem. The majority of drinking water wells are not used on account of their high Fe and Mn concentrations. Iron in particular imparts a taste not acceptable to the majority of people using well water. The occurrence of Fe and Mn in the groundwater of Sri Lanka is largely controlled by the natural environment. The rocks and soils of the area concerned play a significant role in the distribution of iron and manganese in the groundwater. As noted by Herath (1975), extensive bodies of laterites occur in the district of Colombo and along the southwest coast down to Matara and Tangalle. Iron is a very common constituent of the laterites, and since it is geochemically mobile under acidic conditions, it may accumulate in the groundwaters as a result of extensive leaching. Furthermore, the water table in the lateritic terrains is very shallow and may fluctuate rapidly with rainfall. Rainwater may have an impact on groundwater by its own composition as well as by liberation of components from soil. Since the mobility of most trace elements (*eg. Fe, Mn, Zn*) are pH dependent, the slightly acidic nature of wet zone lateritic soils and the intensive rainfall favours the accumulation of Fe in the groundwater. In contrast, the water table in the dry zone of Sri Lanka is very deep – greater than 50 m in some cases. The alkaline soils in the dry zone largely immobilize the iron which form colloidal oxides and hydroxides.

As shown in map No. 10, the highest manganese concentrations of groundwater are recorded in areas around Trincomalee and Tabbowa. The distribution of manganese appears to be associated with sedimentary environments. As noted by Laxen et. al. (1984) there are two main sources of manganese — one is a result of weathering processes which produce suspended particulate sediments. The other is the influx of soluble reduced Mn^{2+} species in varying proportions. The mild reducing environments which usually prevail in Tabbowa and Andigama sedimentary basins and the Mahaweli delta at Trincomalee probably accounts for the higher leaching of Mn^{2+} into the aqueous phase. The distribution of Fe, Mn and other elements in sediments of the sea of Okhotsk (Nissenbaum, 1972) further confirms that Fe is mainly incorporated into the residual fraction whereas Mn is more associated with the aqueous phase.

12. VANADIUM, CHROMIUM, COBALT, COPPER AND ZINC

(Map Nos. 11,12,13,14,15)

Only few waters contain chromium derived from natural sources. Vanadium, cobalt, copper and zinc however occur freely in nature, in minerals, in alluvial deposits and in organic materials. Even so, most waters rarely contain more than traces of these elements. Zinc for example is abundant in rocks and soils but is only a minor constituent in natural waters on account of the low solubility of the free element and oxides.

In the aquatic environment, chromium exists as chromate. The Cr^{3+} ion is hydrolyzed completely in natural waters and the chromium precipitates as the hydroxide leaving minor amounts in solution. Solutions containing cobaltous ions (Co^{2+}) are relatively stable whereas cobaltic ions (Co^{3+}) are strong oxidizing agents and are therefore unstable in natural waters. Copper and zinc in the aqueous phase occur mainly in the ionic forms, and in aquatic organisms and in soluble organic fractions. Vanadium occurs in the aquatic environment as VO_3^- ion. When it comes into contact with organic substances, it may be readily converted to the cationic form VO^{2+} which may be trapped in the organic substrate.

The distribution of V, Cr, Co, Cu and Zn in the groundwater of Sri Lanka is illustrated in maps 11, 12, 13, 14, 15 and table 1. Frequency histograms (fig. 2) for each element show that 15, 18 and 37 wells had > 24 ppb of total Cr > 120 ppb of Co and > 400 ppb of zinc respectively, in the groundwater of Sri Lanka. In the case of Cu and V only 12 and 29 respectively had > 200 ppb concentrations. However with industrial development in Sri Lanka the problem of groundwater pollution is receiving more attention. Field investigations in the Ratmalana area confirm that some wells located near the industries (*5 – 10 m distance between factory and well*) are subjected to pollution from industrial wastes. As a result of this, the Cr content of groundwater in these areas is higher than the values recommended by W.H.O.

The rocks and minerals of the areas under consideration also play a significant role in the distribution of some metals. The rocks in the area covered by the boundary between the Highland Series and the eastern Vijayan Complex in particular, are known to be mineralized and one could therefore expect significant concentrations of metals in these areas.

Table 1. The Maximum, Minimum and Average Trace Element Levels in the Districts of Sri Lanka

| No. District | V (ppb) | | | Co (ppb) | | | Cr (ppb) | | | Cu (ppb) | | | Zn (ppb) | | | | | | |
|------------------|------------|------------|----------------|------------|------------|----------------|----------|------------|------------|----------------|---------|------------|------------|----------------|---------|------------|------------|----------------|-----|
| | Max. Value | Min. Value | No. of samples | Max. Value | Min. Value | No. of samples | Average | Max. Value | Min. Value | No. of samples | Average | Max. Value | Min. Value | No. of samples | Average | Max. Value | Min. Value | No. of samples | |
| 1. Colombo | 721 | 2 | 15 | 221 | 1 | 15 | 90 | 36 | 1 | 14 | 209 | 441 | 1 | 15 | 14 | 712 | 17 | 15 | 195 |
| 2. Kalutara | 100 | 1 | 13 | 32 | 1 | 13 | 18 | 20 | 7 | 13 | 15 | 32 | 11 | 9 | 14 | 18 | 2 | 13 | 9 |
| 3. Gampaha | 117 | 1 | 25 | 17 | 1 | 25 | 18 | 35 | 9 | 24 | 19 | 40 | 2 | 25 | 11 | 94 | 17 | 25 | 64 |
| 4. Kandy | 412 | 1 | 28 | 42 | 1 | 28 | 170 | 22 | 1 | 28 | 10 | 128 | 10 | 28 | 27 | 412 | 27 | 28 | 246 |
| 5. Matale | 27 | 1 | 28 | 117 | 1 | 30 | 7 | 22 | 10 | 30 | 17 | 92 | 32 | 30 | 57 | 517 | 12 | 28 | 226 |
| 6. Nuwara Eliya | 7 | 1 | 17 | 23 | 1 | 17 | 3 | 17 | 2 | 17 | 6 | 82 | 10 | 17 | 42 | 412 | 17 | 17 | 168 |
| 7. Galle | 72 | 2 | 8 | 27 | 10 | 8 | 22 | 23 | 10 | 7 | 19 | 17 | 11 | 7 | 12 | 22 | 13 | 8 | 18 |
| 8. Matara | 50 | 10 | 9 | 27 | 2 | 9 | 32 | 27 | 10 | 3 | 19 | 61 | 2 | 9 | 26 | 24 | 2 | 9 | 145 |
| 9. Hambantota | 320 | 2 | 28 | 22 | 1 | 37 | 101 | 19 | 1 | 37 | 8 | 72 | 2 | 27 | 18 | 232 | 12 | 24 | 54 |
| 10. Jaffna | — | — | — | — | — | — | — | 7 | 1 | 3 | 3 | 20 | 1 | 3 | 7 | 20 | 2 | 3 | 7 |
| 11. Mannar | 62 | 1 | 7 | 11 | 1 | 7 | 8 | 7 | 1 | 7 | 3 | 27 | 10 | 7 | 18 | 45 | 21 | 7 | 28 |
| 12. Vavuniya | 17 | 1 | 9 | 27 | 1 | 9 | 4 | 7 | 1 | 9 | 3 | 27 | 10 | 5 | 18 | 73 | 27 | 9 | 42 |
| 13. Mullativu | 12 | 1 | 3 | 27 | 2 | 3 | 8 | 7 | 2 | 3 | 4 | 19 | 13 | 3 | 15 | 37 | 32 | 3 | 34 |
| 14. Batticaloa | 312 | 13 | 16 | 127 | 11 | 16 | 195 | 7 | 1 | 16 | 4 | 180 | 92 | 16 | 143 | 320 | 31 | 16 | 86 |
| 15. Trincomalee | 712 | 1 | 20 | 217 | 1 | 18 | 51 | 17 | 2 | 18 | 4 | 420 | 17 | 24 | 178 | 1700 | 20 | 21 | 377 |
| 16. Amparai | 320 | 7 | 31 | 142 | 1 | 31 | 49 | 17 | 1 | 26 | 4 | 170 | 12 | 30 | 96 | 317 | 12 | 30 | 71 |
| 17. Kurunegala | 40 | 1 | 54 | 117 | 1 | 55 | 11 | 22 | 2 | 46 | 11 | 79 | 11 | 49 | 47 | 120 | 10 | 52 | 35 |
| 18. Puttalam | 270 | 1 | 22 | 47 | 1 | 21 | 21 | 15 | 1 | 14 | 3 | 73 | 11 | 22 | 33 | 140 | 1 | 23 | 59 |
| 19. Anuradhapura | 417 | 1 | 44 | 127 | 1 | 44 | 141 | 17 | 1 | 45 | 7 | 41 | 17 | 43 | 26 | 720 | 2 | 43 | 90 |
| 20. Polonnaruwa | 117 | 1 | 29 | 273 | 11 | 28 | 22 | 22 | 1 | 29 | 10 | 270 | 10 | 29 | 164 | 500 | 13 | 31 | 236 |
| 21. Badulla | 412 | 117 | 9 | 3 | 1 | 9 | 292 | 17 | 1 | 9 | 7 | 37 | 10 | 9 | 18 | 412 | 217 | 9 | 299 |
| 22. Monaragala | 17 | 1 | 11 | 47 | 1 | 11 | 5 | 20 | 1 | 9 | 7 | 27 | 7 | 11 | 16 | 611 | 13 | 11 | 262 |
| 23. Ratnapura | 26 | 1 | 19 | 22 | 1 | 19 | 8 | 20 | 1 | 19 | 6 | 52 | 6 | 17 | 24 | 412 | 17 | 19 | 224 |
| 24. Kegalle | 48 | 1 | 20 | 173 | 17 | 20 | 16 | 13 | 1 | 20 | 4 | 73 | 41 | 20 | 60 | 200 | 10 | 20 | 51 |

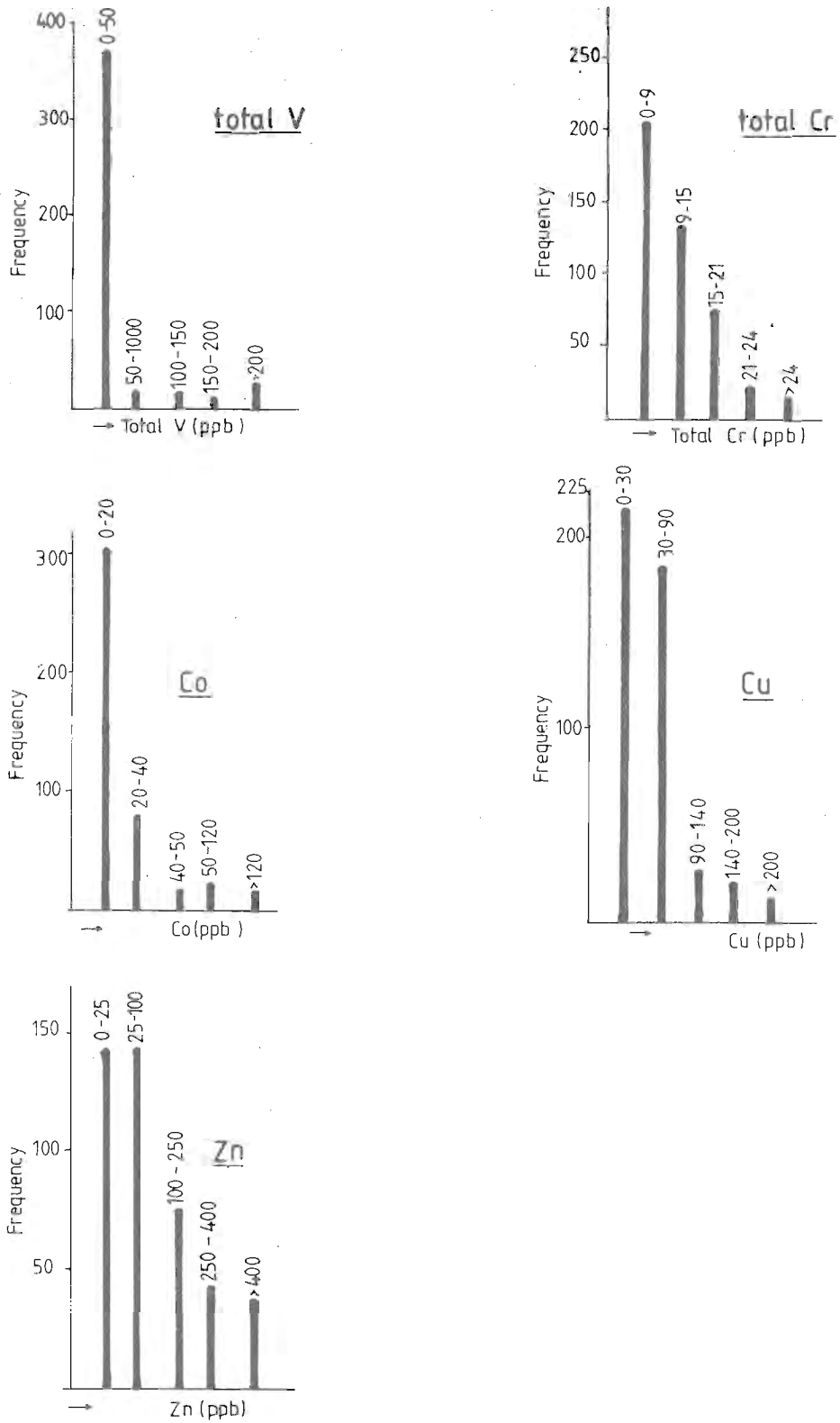


Figure 2 : Frequency histograms for elemental distribution in well water in Sri Lanka.

13. THE GEOCHEMICAL CLASSIFICATION OF GROUNDWATER OF SRI LANKA (Map No. 16)

In Sri Lanka, a country of 15 million people, only 15 – 25% of the people have access to piped water, and the majority of the country's health problems are related to its aquatic environment. The majority use small, unprotected wells, and in rural settlements, reservoirs and water channels are the main sources of drinking water. The proper disposal of human and other wastes through sewerage systems and latrines is also severely limited, less than a third of the population having satisfactory latrine facilities. The poor water supply and excreta disposal systems have resulted in 40% of the Sri Lankan population being affected by typhoid, amoebic and bacillary dysentery, infectious hepatitis, gastro-enteritis, colitis and worm infections. The need to carefully monitor the groundwater quality of Sri Lanka, is therefore of high priority and upto now this aspect has been neglected.

Environmental geochemistry essentially deals with the geographical distribution of elements and forms the basis for a variety of interdisciplinary studies involving human and animal health, quality of groundwater, agriculture and nutrition, soil fertility, pollution and mineral exploration. The study of the abundance and distribution of some trace elements and the resulting biological manifestations involves geochemists, public health workers, soil scientists, ecologists and nutritionists.

The chemical quality of groundwater is related to the geology of the area concerned. For example, areas underlain by acid igneous rocks such as granite or arenaceous sedimentary rocks generally contain lower levels of essential trace elements – particularly the first row transition elements – than areas underlain by ultrabasic and igneous rocks or shale. These however, may sometimes contain sufficient concentrations of potentially toxic elements (*Thornton and Plant, 1980*).

This study presents for the first time, a chemical classification of the groundwater of Sri Lanka. It is hoped that this chemical classification would help not only the hydrogeochemist, but also others in a number of scientific disciplines.

The Chemistry of the Groundwater of Sri Lanka

The groundwater of Sri Lanka can be classified into the following 4 main water types

- i. Calcium type
- ii. Magnesium type
- iii. Sodium/potassium type
- iv. Non-dominant cation type

Map 16 illustrates the distribution of these 4 major water types in Sri Lanka. Each type is further sub-divided into the Cl, SO₄, HCO₃ and NDA types. Table 2 shows the averages for the elements and ionic species.

i. The Calcium Type

Fig. 3 illustrates the Piper trilinear diagrams for the calcium water type. In Sri Lanka, this type of water is distributed mainly in the northern, central and in some parts southern, eastern and north central regions. The Cl type predominates in the northern parts whereas the HCO_3 type is prevalent in the central regions. The effect of salinity and the presence of carbonate rocks in the areas could possibly be attributed to such a distribution. Table 3 shows the correlation matrix for the elements and ionic species analyzed for the calcium type of water in Sri Lanka. The total dissolved solids (*TDS*) show significant correlations with K, Ca, HCO_3 and Cl. The transition elements however show no significant correlations for this type of water.

ii. The Magnesium Type

When compared to the other types of water, the magnesium type is distributed only in relatively smaller areas, the southern parts of the country around Embilipitiya having higher concentrations. In this type of water, only the Cl and SO_4 sub-types could be found. The correlation matrix and the Piper trilinear diagram for the Mg water type are shown in Table 4 and Fig. 4 respectively.

iii. The Sodium/Potassium Type

This type forms a major group and is distributed widely in Sri Lanka, particularly around the central region. The north western, north central and the south eastern dry zones mainly contain this type of groundwater. From among the sub-types, the Cl type is predominantly found in these regions. Excessive evaporation and probable influence of salinity may have contributed to the prevalence of this water type. Table 5 shows the correlation matrix for the Na/K water type and Fig. 5 illustrates the Piper trilinear diagram.

iv. The Non-dominant Cation Type

As illustrated in map. 16, the non-dominant cation type of water is distributed mainly at the periphery of the central highlands and in some parts of the north central and southern regions. The HCO_3 and non-dominant anion sub-types predominate in these regions. Table 6 shows the correlation matrix for the non-dominant cation water type and fig.6 illustrates the Piper trilinear diagrams.

Effect of Geology and Climate on the Chemistry of Groundwater

A closer study of the distribution patterns of the groundwater types in Sri Lanka reveals that the underlying geology and the climatic factors affect the chemical quality of water to a great extent. The wet zone of Sri Lanka (*see map. 16*) consists for the most part of non-dominant cation type, calcium — HCO_3 and non-dominant anion types. In the dry zone however, the Na/K type predominates and in this type of water, the Cl sub-type is found covering vast areas of the dry zone. Evaporation under the strong drought conditions as prevailing in the dry zone of Sri Lanka results in the accumulation of sodium salts in the soil

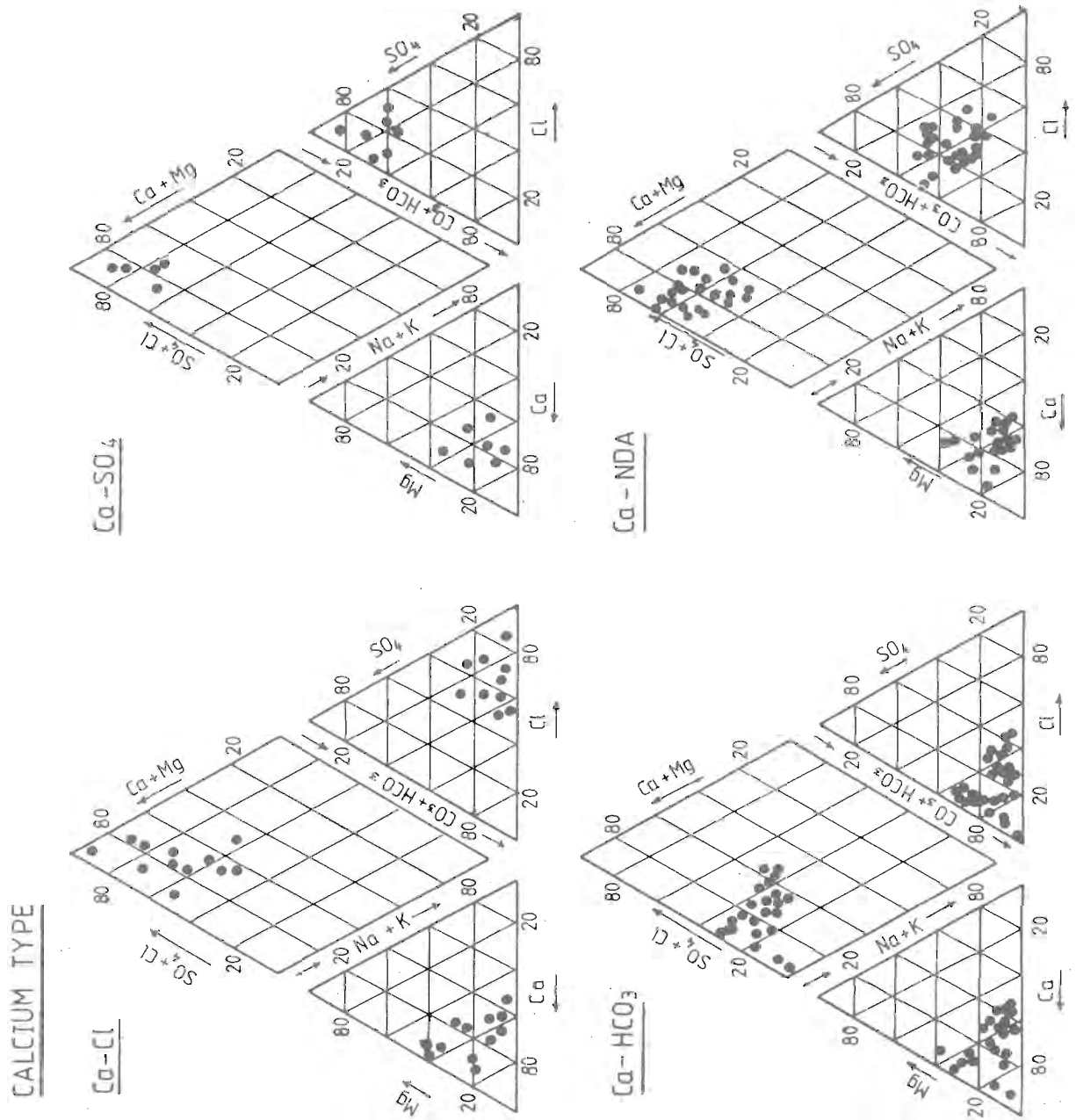


Figure 3 : Piper trilinear diagrams for the calcium water type.

Table 2 - Average Elements and Ionic Species for the Different Water Types of Sri Lanka

| Water type | Na | K | Ca | Mg | HCO ₃ | SO ₄ | Cl | Fe | Mn | Cr | Co | V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | F | SiO ₂ | TDS | total Hardness |
|------------|-----|-----|-----|-----|------------------|-----------------|-----|------|-----|-----|-----|-----|-----|-----|-----------------|-----------------|-----------------|------|------------------|-----|----------------|
| | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppm | ppm |
| Ca-type | 28 | 15 | 78 | 13 | 222 | 41 | 62 | 1088 | 76 | 11 | 28 | 58 | 40 | 137 | 4657 | 113 | 229 | 1006 | 19 | 358 | 245 |
| Mg-type | 39 | 38 | 104 | 158 | 393 | 649 | 38 | 1457 | 65 | 13 | 9 | 38 | 45 | 84 | 1614 | 62 | 97 | 638 | 10 | 761 | 938 |
| Na/K-type | 345 | 35 | 82 | 18 | 253 | 36 | 589 | 1443 | 112 | 11 | 27 | 51 | 66 | 129 | 6128 | 114 | 175 | 1121 | 25 | 617 | 305 |
| NDC-type | 81 | 19 | 76 | 25 | 253 | 45 | 195 | 1098 | 79 | 10 | 18 | 22 | 52 | 113 | 3966 | 113 | 221 | 983 | 18 | 603 | 255 |

Table 3 - Correlation Matrix for the Calcium Water Type

| | Na | K | Ca | Mg | HCO ₃ | SO ₄ | Cl | Fe | Mn | Cr | Co | V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | F | SiO ₂ | TDS |
|------------------|-------|--------|--------|--------|------------------|-----------------|--------|--------|-------|--------|--------|--------|--------|--------|-----------------|-----------------|-----------------|--------|------------------|---------|
| Na | 1.000 | 0.472* | 0.479* | -0.021 | 0.344 | 0.028 | 0.737* | -0.177 | 0.063 | -0.107 | 0.019 | 0.072 | 0.317 | -0.006 | 0.004 | -0.093 | -0.045 | 0.210 | 0.187 | 0.436 |
| K | | 1.000 | 0.448 | 0.021 | 0.290 | 0.012 | 0.728* | -0.117 | 0.079 | -0.148 | -0.037 | 0.040 | 0.074 | -0.081 | -0.077 | -0.012 | 0.002 | 0.055 | 0.205 | -0.534* |
| Ca | | | 1.000 | 0.175 | 0.851* | 0.312 | 0.593* | -0.181 | 0.089 | -0.113 | 0.002 | 0.137 | 0.249 | 0.027 | -0.159 | -0.146 | 0.077 | 0.244 | 0.149 | 0.784* |
| Mg | | | | 1.000 | 0.272 | 0.331 | -0.011 | -0.026 | 0.141 | -0.043 | -0.084 | -0.010 | 0.083 | 0.023 | 0.012 | 0.149 | 0.069 | -0.050 | 0.035 | 0.249 |
| HCO ₃ | | | | | 1.000 | 0.190 | 0.342 | -0.315 | 0.134 | -0.182 | 0.062 | 0.185 | 0.322 | 0.156 | -0.288 | -0.031 | 0.216 | 0.301 | 0.033 | 0.596* |
| SO ₄ | | | | | | 1.000 | -0.003 | 0.171 | 0.188 | 0.134 | -0.030 | 0.109 | 0.080 | -0.014 | -0.045 | -0.054 | -0.048 | -0.057 | 0.143 | 0.108 |
| Cl | | | | | | | 1.000 | -0.123 | 0.053 | -0.103 | -0.025 | 0.012 | 0.150 | -0.087 | 0.026 | -0.112 | -0.021 | 0.160 | 0.248 | 0.654* |
| Fe | | | | | | | | 1.000 | 0.094 | 0.189 | -0.049 | -0.100 | -0.297 | -0.230 | 0.192 | -0.112 | -0.155 | -0.228 | 0.072 | -0.201 |
| Mn | | | | | | | | | 1.000 | 0.117 | -0.024 | 0.164 | 0.194 | -0.041 | -0.177 | 0.086 | 0.119 | 0.034 | 0.067 | 0.058 |
| Cr | | | | | | | | | | 1.000 | -0.143 | -0.166 | -0.120 | 0.083 | 0.074 | -0.071 | -0.098 | 0.041 | -0.013 | -0.074 |
| Co | | | | | | | | | | | 1.000 | 0.028 | 0.100 | -0.098 | -0.080 | -0.064 | 0.073 | 0.145 | -0.078 | -0.028 |
| V | | | | | | | | | | | | 1.000 | 0.028 | 0.173 | -0.198 | -0.081 | -0.091 | 0.007 | 0.116 | -0.112 |
| Cu | | | | | | | | | | | | | 1.000 | 0.080 | 0.197 | 0.185 | 0.395 | 0.294 | -0.149 | 0.204 |
| Zn | | | | | | | | | | | | | | 1.000 | -0.222 | -0.063 | -0.091 | 0.278 | -0.071 | -0.036 |
| NO ₃ | | | | | | | | | | | | | | | 1.000 | -0.325 | -0.216 | -0.189 | 0.048 | -0.132 |
| NO ₂ | | | | | | | | | | | | | | | | 1.000 | 0.165 | 0.129 | -0.152 | 0.099 |
| NH ₄ | | | | | | | | | | | | | | | | | 1.000 | -0.048 | 0.028 | 0.107 |
| F | | | | | | | | | | | | | | | | | | 1.000 | -0.006 | 0.184 |
| SiO ₂ | | | | | | | | | | | | | | | | | | | 1.000 | 0.214 |
| TDS | | | | | | | | | | | | | | | | | | | | 1.000 |

* Significant at 95% confidence level

Table 4 - Correlation Matrix for the Magnesium Water Type

| | Na | K | Ca | Mg | HCO ₃ | SO ₄ | Cl | Fe | Mn | Cr | Co | V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | F | SiO ₂ | TDS |
|------------------|-------|--------|--------|--------|------------------|-----------------|--------|---------|--------|--------|--------|--------|---------|--------|-----------------|-----------------|-----------------|---------|------------------|--------|
| Na | 1.000 | 0.931* | 0.954* | 0.882* | 0.834* | 0.947* | -0.379 | 0.237 | 0.298 | 0.068 | -0.306 | 0.003 | -0.233 | -0.063 | 0.246 | -0.163 | -0.111 | -0.170 | -0.202 | -0.177 |
| K | | 1.000 | 0.957* | 0.808* | 0.764* | 0.919* | -0.166 | 0.075 | 0.286 | -0.088 | -0.099 | -0.005 | -0.041 | -0.091 | 0.127 | -0.137 | -0.073 | -0.089 | -0.064 | 0.007 |
| Ca | | | 1.000 | 0.876* | 0.828* | 0.964* | -0.162 | 0.129 | 0.225 | 0.026 | -0.081 | 0.014 | -0.020 | -0.142 | 0.153 | -0.199 | -0.115 | 0.137 | -0.151 | -0.067 |
| Mg | | | | 1.000 | 0.874* | 0.956* | -0.465 | 0.283 | 0.448 | 0.166 | -0.389 | 0.234 | -0.278 | -0.197 | 0.081 | -0.207 | -0.163 | -0.144 | -0.362 | 0.082 |
| HCO ₃ | | | | | 1.000 | 0.813* | -0.251 | 0.032 | 0.239 | 0.048 | -0.156 | 0.105 | -0.029 | -0.164 | 0.131 | -0.115 | -0.069 | 0.020 | -0.313 | -0.007 |
| SO ₄ | | | | | | 1.000 | -0.354 | 0.252 | 0.369 | 0.111 | -0.284 | 0.123 | -0.212 | -0.148 | 0.126 | -0.202 | -0.156 | -0.173 | -0.228 | 0.009 |
| Cl | | | | | | | 1.000 | -0.525* | -0.424 | -0.305 | 0.977* | -0.054 | 0.858* | -0.034 | -0.179 | 0.065 | -0.077 | 0.041 | 0.292 | 0.157 |
| Fe | | | | | | | | 1.000 | 0.399 | 0.328 | -0.427 | 0.200 | -0.631* | -0.328 | 0.327 | -0.336 | -0.597* | -0.595* | -0.345 | 0.067 |
| Mn | | | | | | | | | 1.000 | -0.037 | -0.403 | 0.628* | -0.459 | -0.241 | -0.553* | -0.326 | -0.327 | -0.248 | -0.270 | 0.416 |
| Cr | | | | | | | | | | 1.000 | -0.229 | 0.330 | -0.434 | 0.265 | 0.259 | -0.010 | -0.290 | -0.540* | -0.138 | -0.265 |
| Co | | | | | | | | | | | 1.000 | -0.016 | 0.844* | -0.128 | -0.142 | -0.011 | -0.150 | -0.027 | 0.220 | 0.190 |
| V | | | | | | | | | | | | 1.000 | -0.155 | -0.337 | -0.430 | -0.406 | -0.467 | -0.305 | -0.594* | 0.487 |
| Cu | | | | | | | | | | | | | 1.000 | -0.131 | -0.144 | -0.139 | -0.066 | 0.261 | 0.225 | 0.306 |
| Zn | | | | | | | | | | | | | | 1.000 | 0.159 | 0.337* | -0.077 | -0.255 | 0.723* | -0.307 |
| NO ₃ | | | | | | | | | | | | | | | 1.000 | 0.239 | -0.178 | -0.253 | -0.033 | -0.370 |
| NO ₂ | | | | | | | | | | | | | | | | 1.000 | -0.007 | -0.169 | 0.685* | 0.080 |
| NH ₄ | | | | | | | | | | | | | | | | | 1.000 | 0.892* | 0.100 | -0.410 |
| F | | | | | | | | | | | | | | | | | | 1.000 | -0.912* | 0.125 |
| SiO ₂ | | | | | | | | | | | | | | | | | | | 1.000 | -0.115 |
| TDS | | | | | | | | | | | | | | | | | | | | 1.000 |

* Significant at 95% confidence level

MAGNESIUM TYPE

Mg - Cl

Mg - SO₄

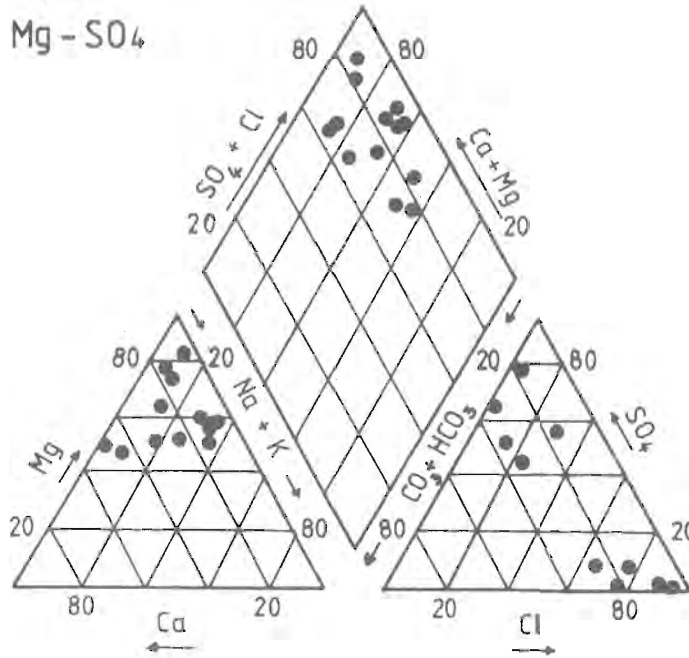


Figure 4 : Piper trilinear diagrams for the magnesium water type.

Table 5 - Correlation Matrix for the Sodium/Potassium Water Type

| | Na | K | Ca | Mg | HCO ₃ | SO ₄ | Cl | Fe | Mn | Cr | Co | V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | F | SiO ₂ | TDS |
|------------------|-------|-------|--------|--------|------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------|-----------------|-----------------|--------|------------------|--------|
| Na | 1.000 | 0.077 | 0.634* | 0.472* | 0.635* | 0.093 | 0.950* | -0.045 | 0.206 | -0.320 | 0.269 | 0.007 | 0.322 | 0.217 | -0.115 | -0.248 | 0.193 | 0.218 | 0.123 | 0.400* |
| K | | 1.000 | 0.076 | 0.002 | 0.051 | 0.145 | 0.155 | -0.123 | 0.020 | -0.161 | 0.005 | 0.028 | -0.100 | -0.042 | -0.134 | -0.165 | 0.076 | -0.307 | 0.039 | -0.008 |
| Ca | | | 1.000 | 0.581* | 0.894* | 0.176 | 0.686* | -0.215 | 0.067 | -0.305 | 0.155 | -0.007 | 0.265 | 0.156 | -0.162 | -0.318 | 0.429* | 0.219 | 0.169 | 0.496* |
| Mg | | | | 1.000 | 0.677* | 0.277 | 0.519 | -0.168 | -0.041 | -0.262 | -0.176 | 0.099 | 0.213 | 0.119 | -0.214 | -0.222 | 0.156 | 0.127 | 0.184 | 0.297 |
| HCO ₃ | | | | | 1.000 | 0.064 | 0.661* | -0.213 | 0.012 | -0.307 | -0.067 | -0.075 | 0.375 | 0.077 | -0.131 | -0.302 | 0.385 | 0.202 | 0.156 | 0.526* |
| SO ₄ | | | | | | 1.000 | 0.076 | -0.206 | 0.092 | 0.124 | -0.175 | 0.074 | -0.019 | -0.102 | -0.132 | -0.154 | 0.047 | 0.044 | 0.194 | 0.004 |
| Cl | | | | | | | 1.000 | -0.051 | 0.237 | -0.308 | 0.301 | 0.001 | 0.340 | 0.268 | -0.193 | -0.272 | 0.167 | 0.247 | 0.128 | 0.445* |
| Fe | | | | | | | | 1.000 | 0.244 | 0.355 | 0.206 | -0.009 | -0.061 | 0.142 | 0.225 | 0.144 | -0.107 | -0.054 | -0.147 | -0.154 |
| Mn | | | | | | | | | 1.000 | -0.050 | 0.273 | 0.130 | 0.446* | 0.268 | 0.053 | -0.048 | 0.046 | 0.300 | -0.103 | 0.002 |
| Cr | | | | | | | | | | 1.000 | -0.103 | 0.014 | -0.259 | 0.098 | 0.102 | 0.255 | -0.148 | -0.114 | -0.213 | -0.123 |
| Co | | | | | | | | | | | 1.000 | 0.241 | 0.181 | 0.213 | -0.125 | 0.083 | 0.250 | -0.050 | 0.072 | |
| V | | | | | | | | | | | | 1.000 | 0.050 | 0.050 | 0.196 | -0.119 | -0.029 | 0.155 | -0.046 | -0.109 |
| Cu | | | | | | | | | | | | | 1.000 | 0.305 | 0.016 | -0.186 | 0.076* | 0.493 | 0.024 | 0.236 |
| Zn | | | | | | | | | | | | | | 1.000 | 0.002 | -0.020 | 0.061 | 0.322 | 0.050 | 0.005 |
| NO ₃ | | | | | | | | | | | | | | | 1.000 | 0.199 | 0.030 | -0.183 | -0.024 | -0.140 |
| NO ₂ | | | | | | | | | | | | | | | | 1.000 | -0.127 | -0.210 | -0.133 | -0.176 |
| NH ₄ | | | | | | | | | | | | | | | | | 1.000 | -0.068 | 0.131 | 0.294 |
| F | | | | | | | | | | | | | | | | | | 1.000 | -0.036 | 0.043 |
| SiO ₂ | | | | | | | | | | | | | | | | | | | 1.000 | 0.093 |
| TDS | | | | | | | | | | | | | | | | | | | | 1.000 |

* Significant at 95% confidence level

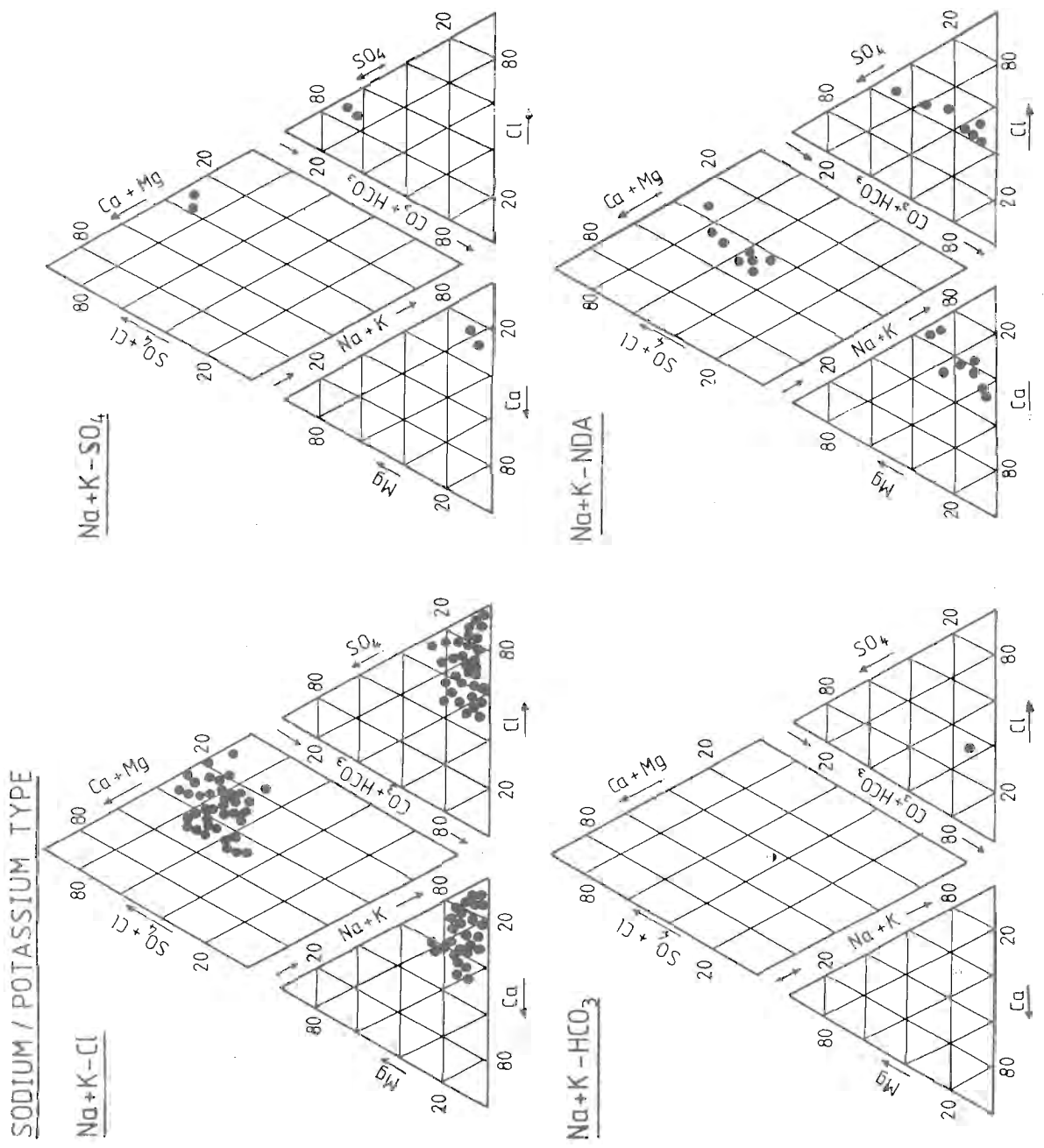


Figure 5 : Piper trilinear diagrams for the sodium/potassium water type.

Table 6 — Correlation Matrix for the Non-dominant Cation (NDC) Water Type

| | Na | K | Ca | Mg | HCO ₃ | SO ₄ | Cl | Fe | Mn | Cr | Co | V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | F | SiO ₂ | TDS |
|------------------|-------|-------|--------|--------|------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------|-----------------|-----------------|--------|------------------|--------|
| Na | 1.000 | 0.159 | 0.570* | 0.331 | 0.497* | 0.018 | 0.793* | -0.142 | 0.009 | -0.116 | 0.024 | -0.044 | -0.001 | -0.089 | -0.143 | -0.124 | -0.042 | 0.103 | 0.140 | 0.307 |
| K | | 1.000 | 0.542* | 0.399 | 0.436 | 0.279 | 0.249 | -0.096 | -0.009 | -0.030 | 0.214 | 0.097 | 0.260 | 0.136 | -0.039 | -0.152 | 0.005 | 0.091 | 0.206 | 0.492 |
| Ca | | | 1.000 | 0.571* | 0.856* | 0.215 | 0.586* | -0.255 | -0.050 | -0.172 | 0.109 | 0.026 | 0.323 | -0.189 | -0.199 | -0.224 | 0.120 | 0.240 | 0.436 | 0.760 |
| Mg | | | | 1.000 | 0.691* | 0.472* | 0.290 | -0.200 | -0.049 | -0.133 | -0.064 | 0.043 | 0.114 | -0.100 | -0.207 | -0.941* | 0.209 | 0.183 | 0.328 | 0.509 |
| HCO ₃ | | | | | 1.000 | 0.051 | 0.486* | -0.333 | -0.118 | -0.126 | 0.113 | 0.047 | 0.436 | -0.098 | -0.204 | -0.134 | 0.250 | 0.304 | 0.374 | 0.780 |
| SO ₄ | | | | | | 1.000 | 0.023 | 0.062 | +0.045 | 0.023 | -0.055 | -0.032 | 0.149 | -0.117 | -0.078 | -0.153 | 0.004 | -0.047 | 0.190 | 0.972 |
| Cl | | | | | | | 1.000 | -0.165 | -0.046 | -0.096 | 0.222 | -0.045 | 0.044 | -0.021 | -0.168 | -0.158 | -0.045 | 0.167 | 0.168 | 0.326 |
| Fe | | | | | | | | 1.000 | -0.024 | 0.167 | -0.169 | 0.005 | -0.314 | 0.254 | 0.215 | -0.029 | 0.017 | 0.228 | -0.095 | -0.233 |
| Mn | | | | | | | | | 1.000 | -0.003 | -0.003 | 0.082 | -0.098 | 0.185 | 0.097 | 0.038 | -0.204 | -0.077 | -0.105 | -0.172 |
| Cr | | | | | | | | | | 1.000 | -0.149 | -0.140 | -0.065 | 0.142 | 0.188 | -0.003 | 0.070 | -0.027 | -0.166 | -0.063 |
| Co | | | | | | | | | | | 1.000 | -0.042 | 0.066 | -0.078 | -0.168 | -0.144 | -0.006 | 0.055 | 0.170 | 0.202 |
| V | | | | | | | | | | | | 1.000 | 0.199 | 0.001 | 0.174 | -0.015 | -0.004 | 0.091 | 0.036 | -0.030 |
| Cu | | | | | | | | | | | | | 1.000 | -0.065 | -0.009 | 0.105 | 0.018 | 0.280 | 0.097 | 0.348 |
| Zn | | | | | | | | | | | | | | 1.000 | -0.006 | -0.033 | 0.351 | 0.409 | -0.290 | -0.211 |
| NO ₃ | | | | | | | | | | | | | | | 1.000 | 0.124 | -0.104 | -0.234 | -0.234 | -0.207 |
| NO ₂ | | | | | | | | | | | | | | | | 1.000 | -0.187 | -0.114 | -0.120 | -0.172 |
| NH ₄ | | | | | | | | | | | | | | | | | 1.000 | 0.114 | 0.071 | 0.017 |
| F | | | | | | | | | | | | | | | | | | 1.000 | +0.052 | 0.166 |
| SiO ₂ | | | | | | | | | | | | | | | | | | | 1.000 | 0.452 |
| TDS | | | | | | | | | | | | | | | | | | | | 1.000 |

* Significant at 95% confidence level

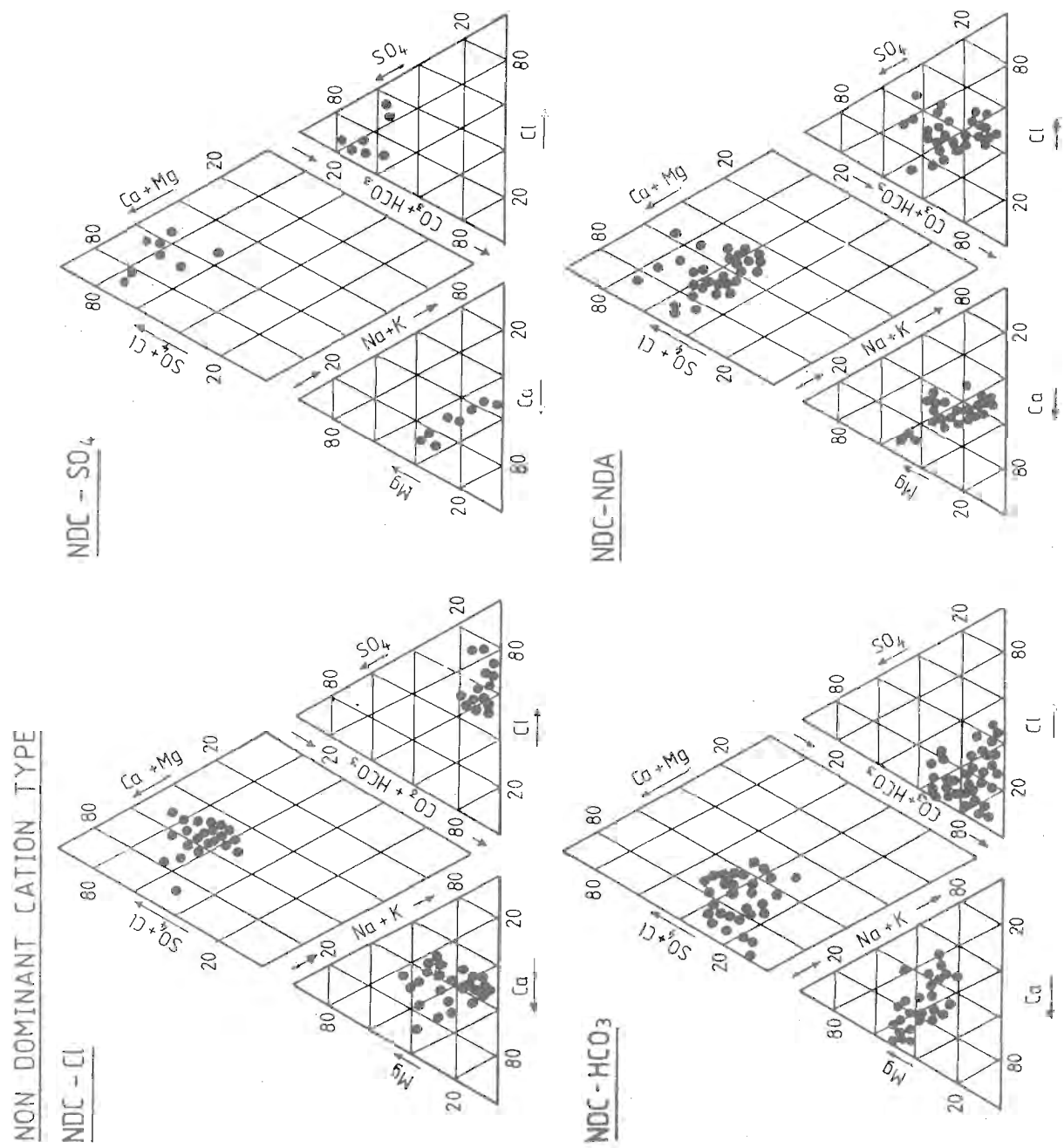


Figure 6 : Piper trilinear diagrams for the non-dominant cation water type.

layers and this factor is largely responsible for the abundance of the Na/K type in the dry zone. Further, the northern parts of Sri Lanka are underlain by sedimentary limestones as a result of which the calcium type of water predominates in these parts. Increasing salinity has been observed in areas closer to the shore-lines and in the Jaffna Peninsula in particular, this is commonly seen. The predominating anion in this type of water in the dry zone is Cl.

When one considers the topography, the central highlands have groundwater of the Ca - HCO₃ type and with decreasing elevation, merges into the non-dominant cation type. In the lowlands the Na/K type predominates. Thus a Ca⁺ NDC⁺ Na/K type of sequence is apparent with decreasing elevations from the highlands to lowlands. This sequence could well be due to the different geochemical mobilities of the elements concerned. Further, there are numerous shallow and deep seated fractures and lineaments within the central regions of Sri Lanka and these are mainly responsible for the migration of groundwater within the hardrock terrains.

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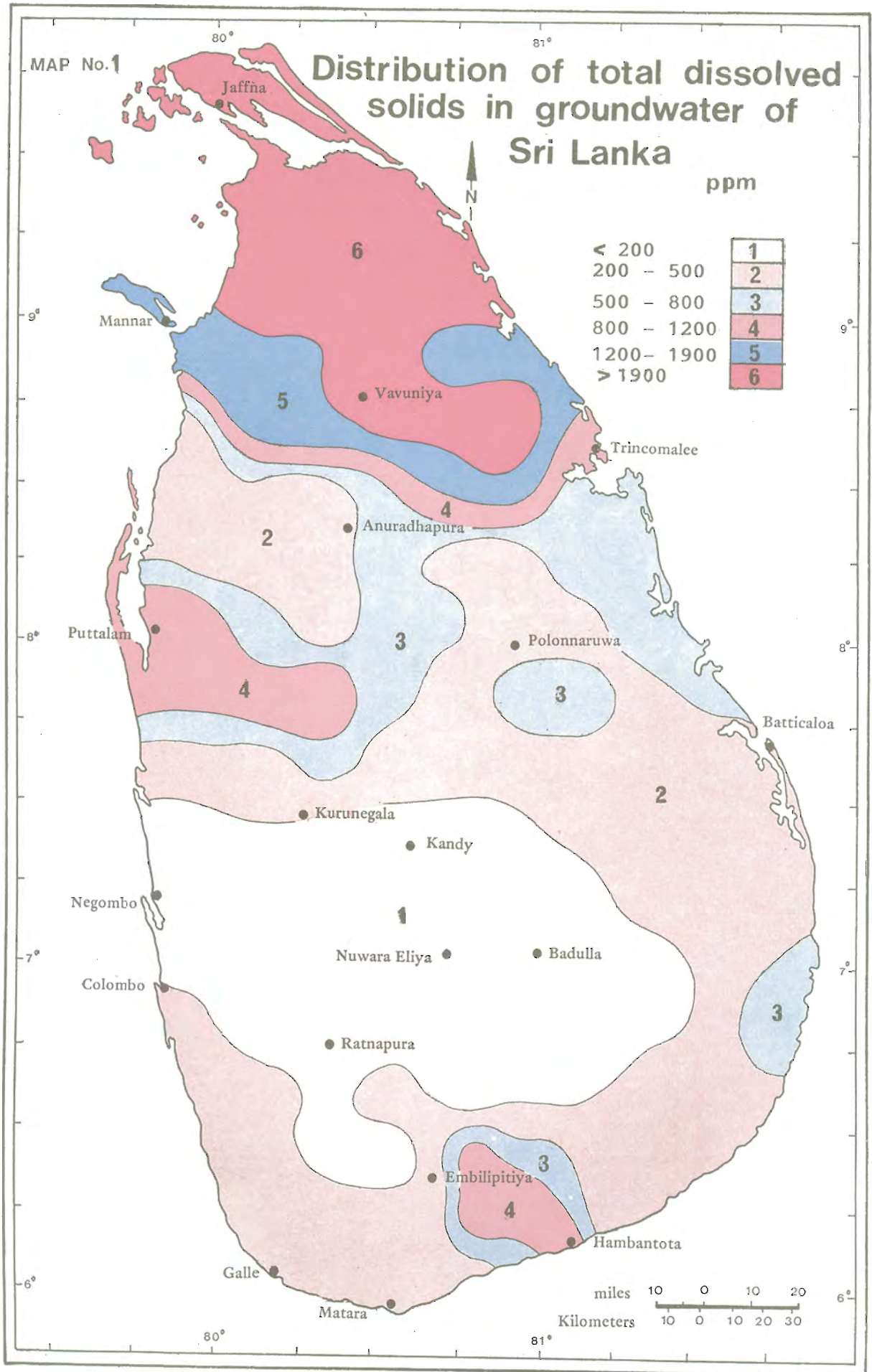
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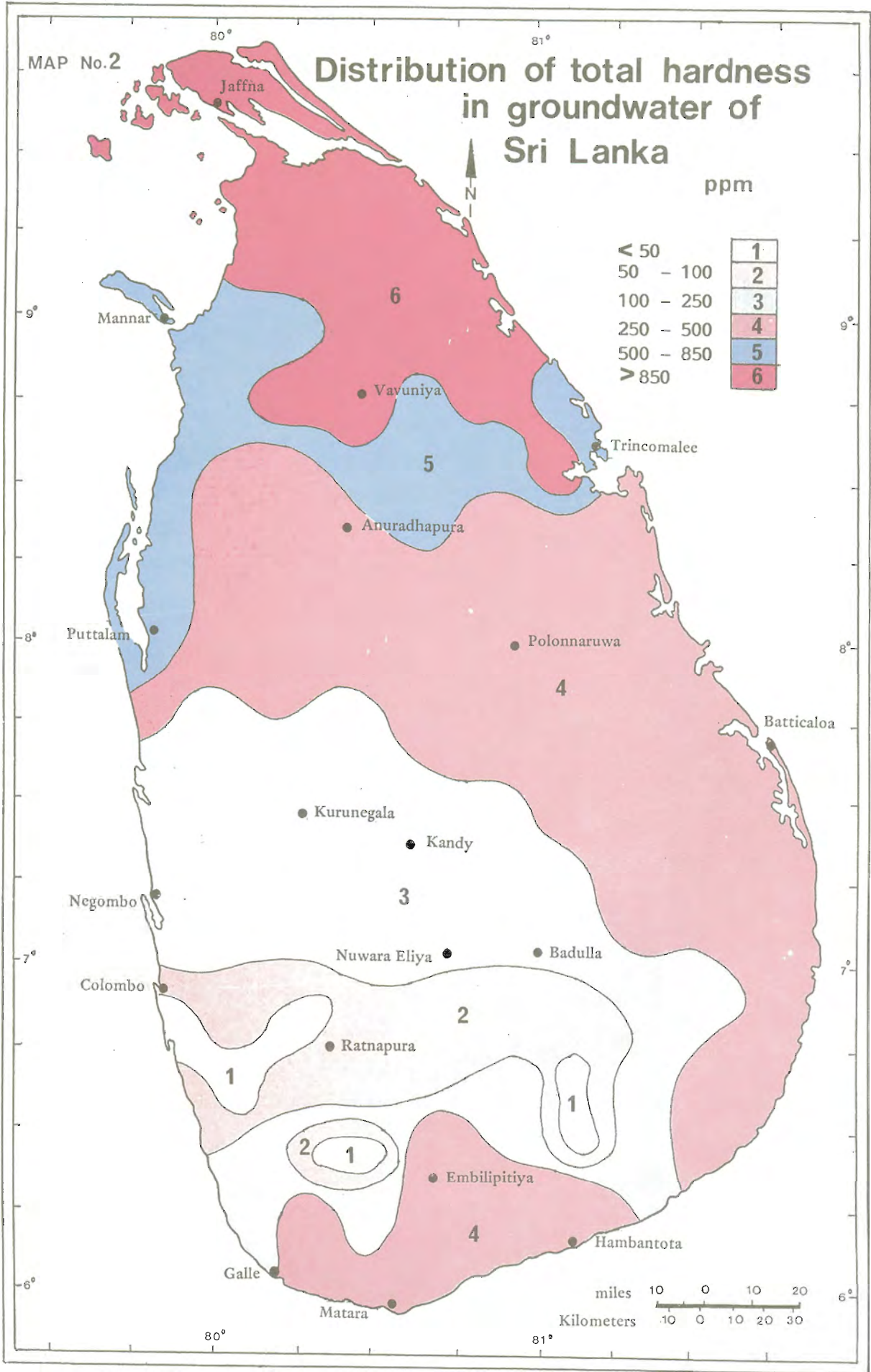
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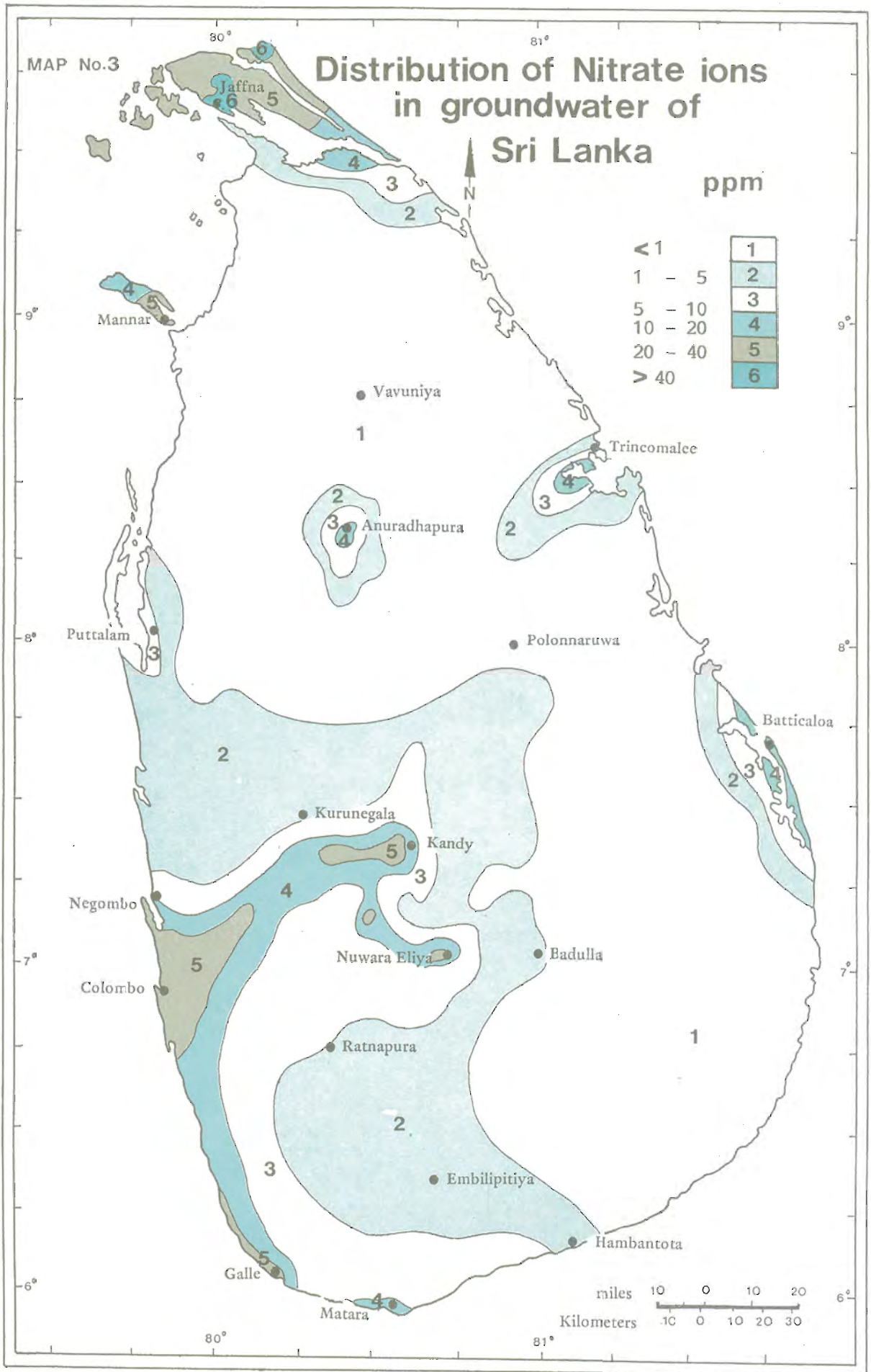
Distribution of total dissolved solids in groundwater of Sri Lanka

ppm

| | |
|-------------|---|
| < 200 | 1 |
| 200 - 500 | 2 |
| 500 - 800 | 3 |
| 800 - 1200 | 4 |
| 1200 - 1900 | 5 |
| > 1900 | 6 |





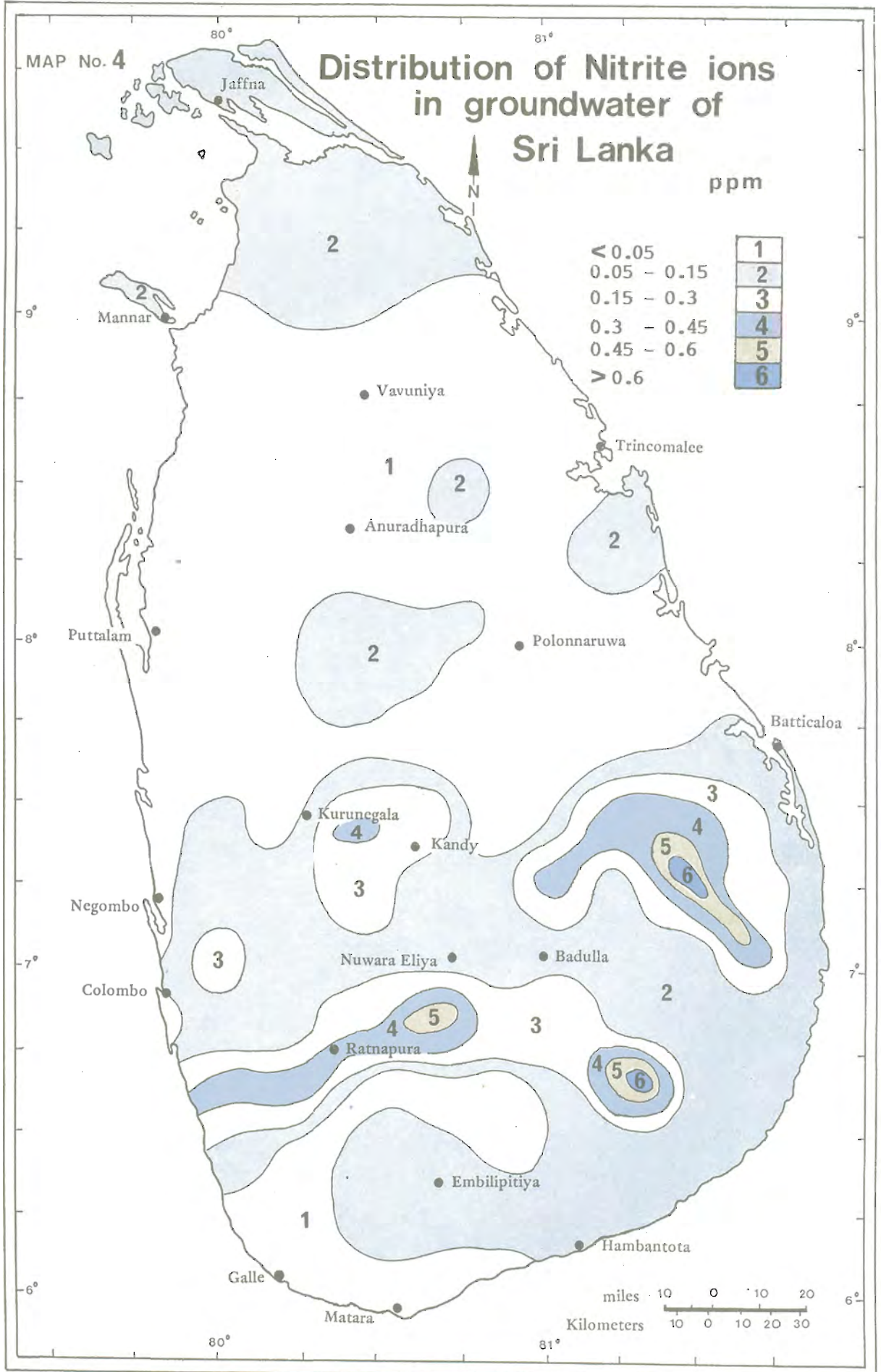


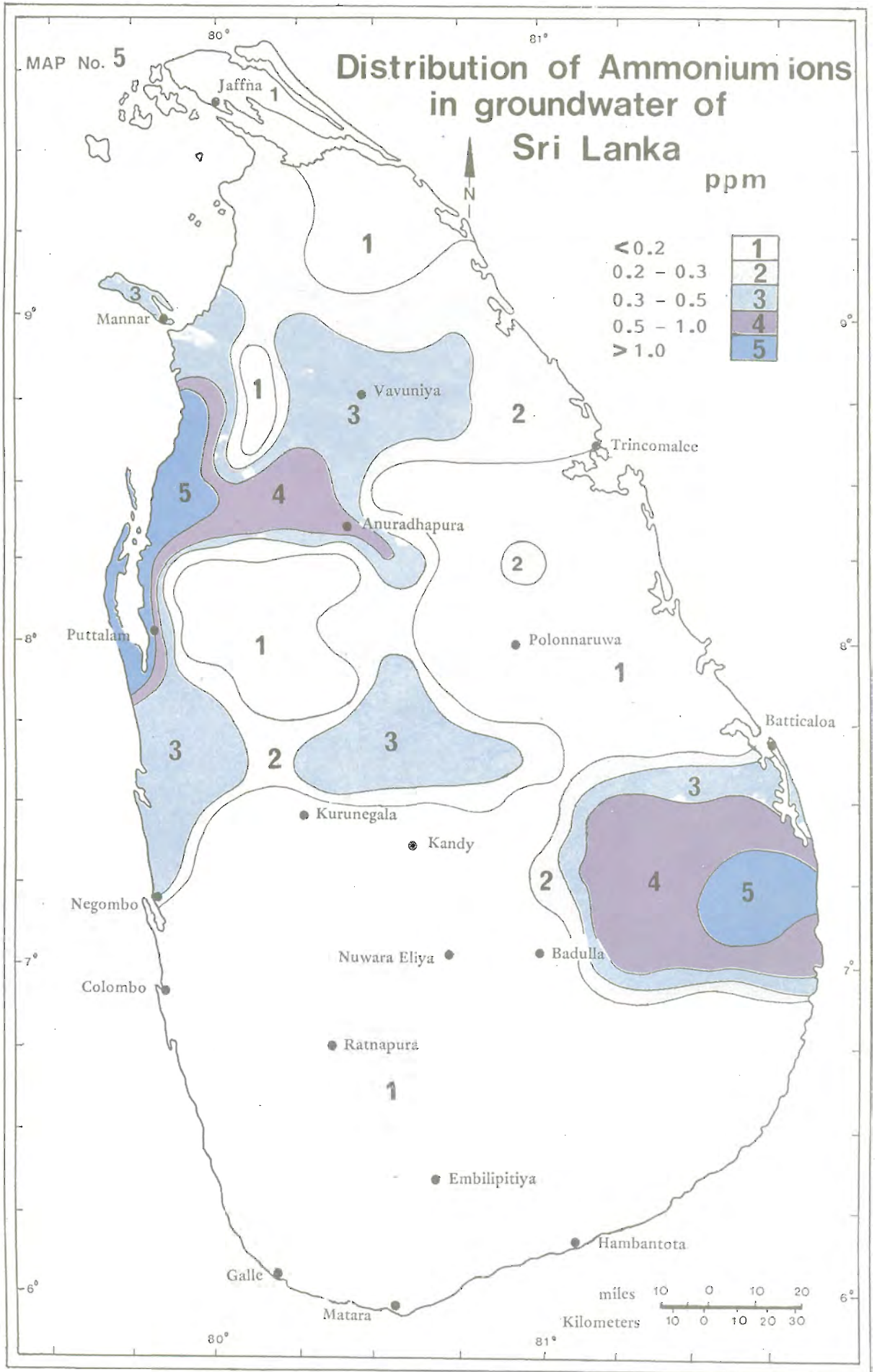
MAP No. 4

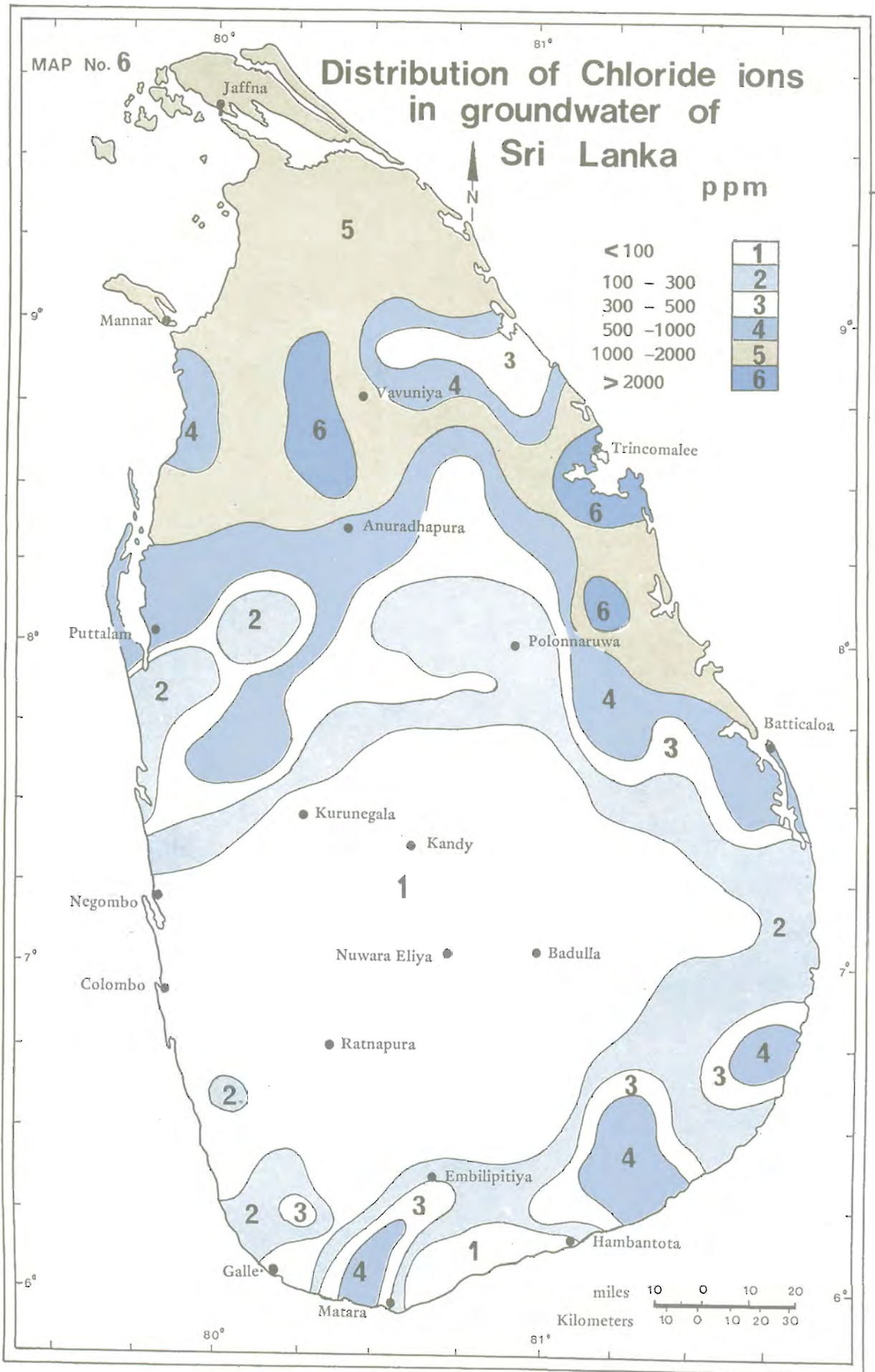
Distribution of Nitrite ions in groundwater of Sri Lanka

ppm

< 0.05
0.05 - 0.15
0.15 - 0.3
0.3 - 0.45
0.45 - 0.6
> 0.6





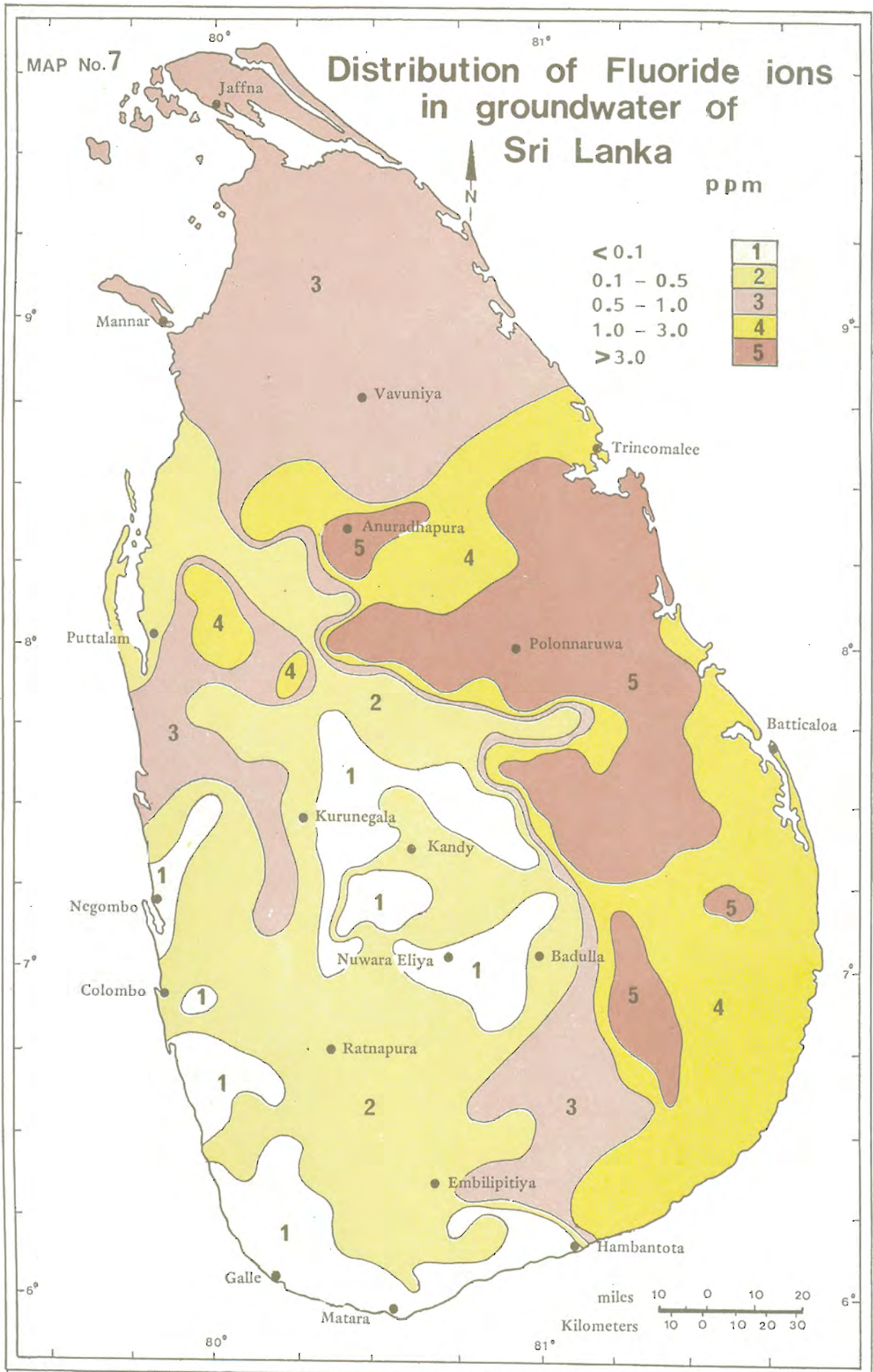


MAP No. 7

Distribution of Fluoride ions in groundwater of Sri Lanka

ppm

< 0.1
0.1 - 0.5
0.5 - 1.0
1.0 - 3.0
> 3.0

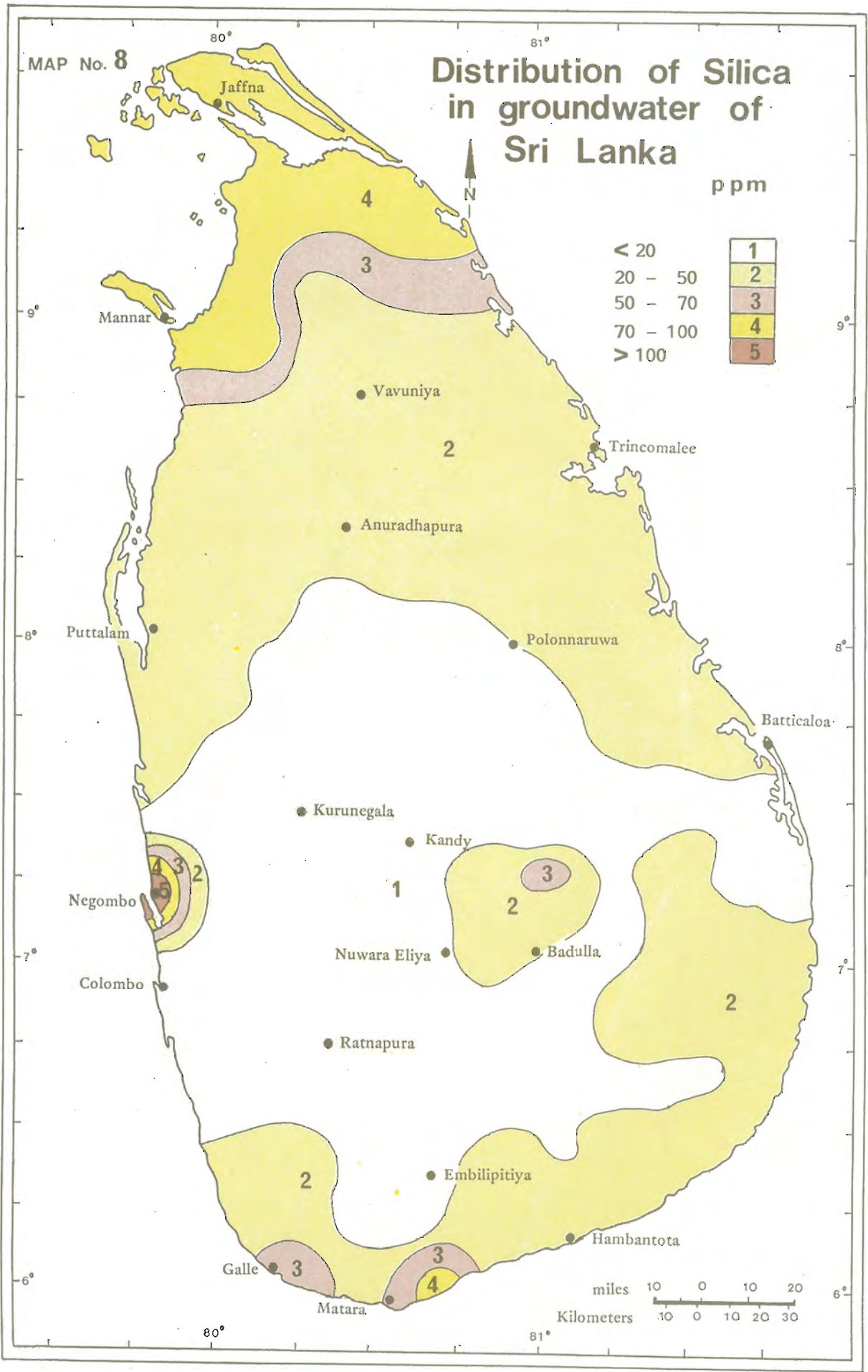


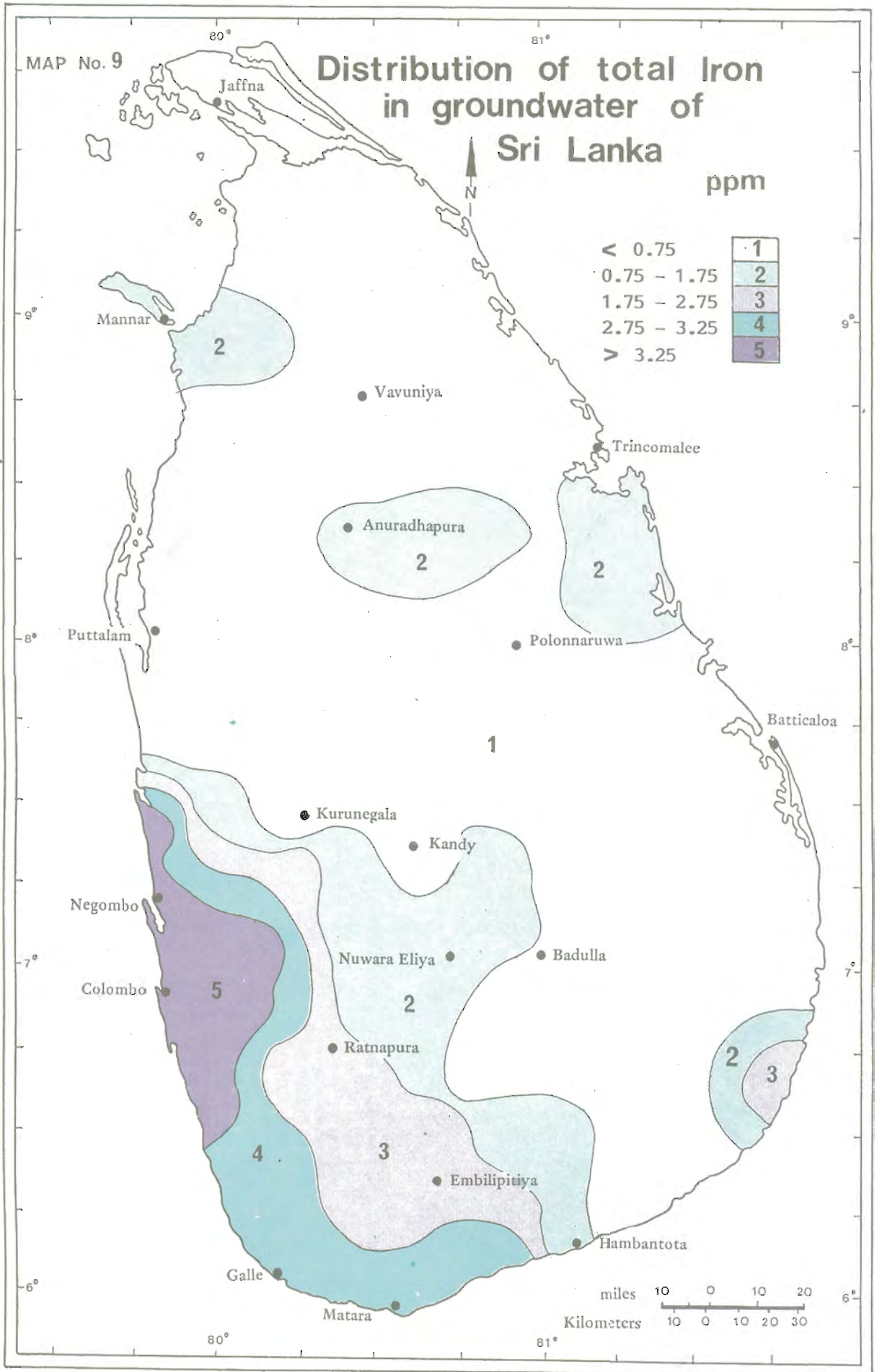
MAP No. 8

Distribution of Silica in groundwater of Sri Lanka

ppm

| | |
|----------|---|
| < 20 | 1 |
| 20 - 50 | 2 |
| 50 - 70 | 3 |
| 70 - 100 | 4 |
| > 100 | 5 |



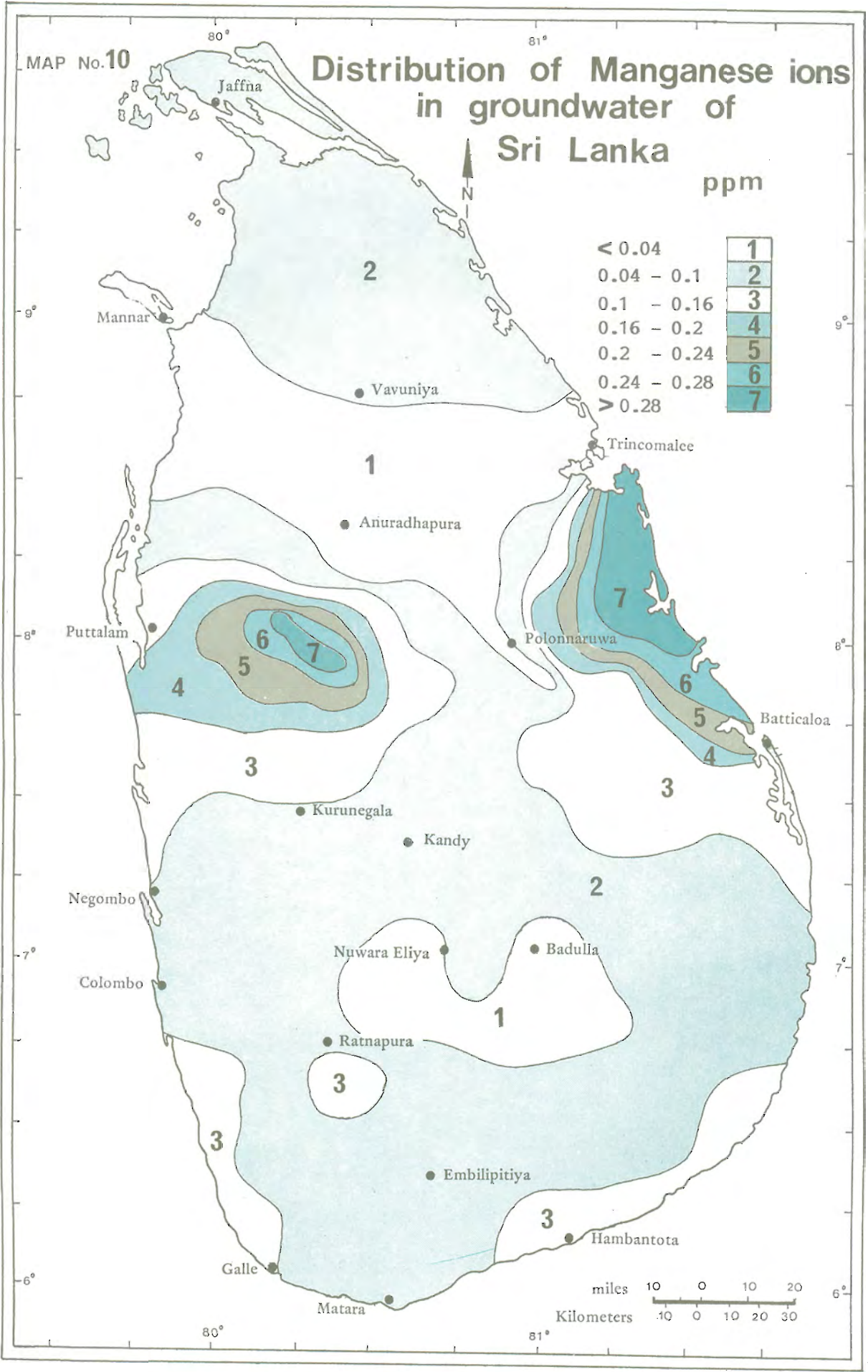


MAP No.10

Distribution of Manganese ions in groundwater of Sri Lanka

ppm

| | |
|-------------|---|
| < 0.04 | 1 |
| 0.04 - 0.1 | 2 |
| 0.1 - 0.16 | 3 |
| 0.16 - 0.2 | 4 |
| 0.2 - 0.24 | 5 |
| 0.24 - 0.28 | 6 |
| > 0.28 | 7 |

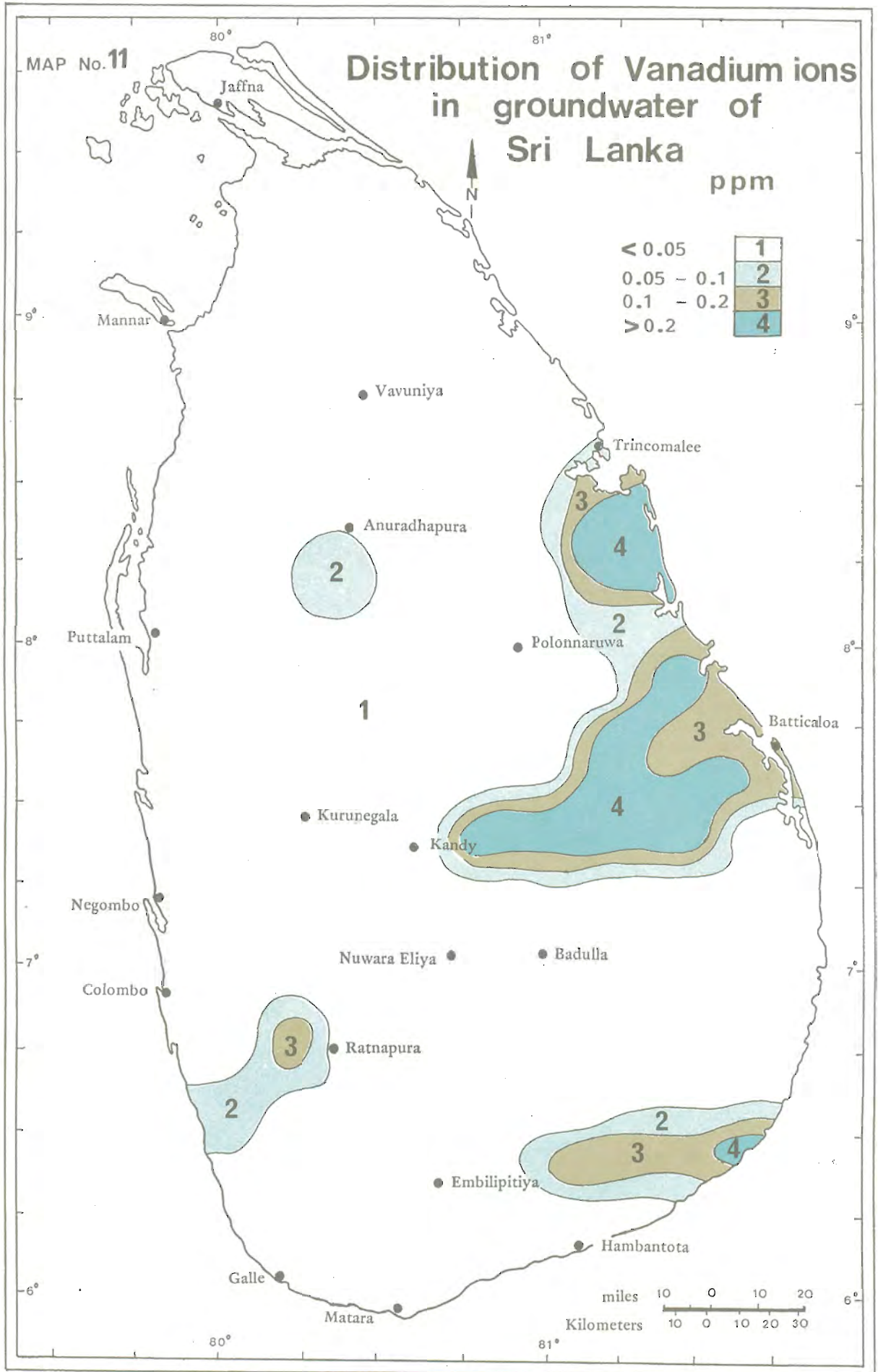


MAP No. 11

Distribution of Vanadium ions in groundwater of Sri Lanka

ppm

| | |
|------------|---|
| < 0.05 | 1 |
| 0.05 - 0.1 | 2 |
| 0.1 - 0.2 | 3 |
| > 0.2 | 4 |



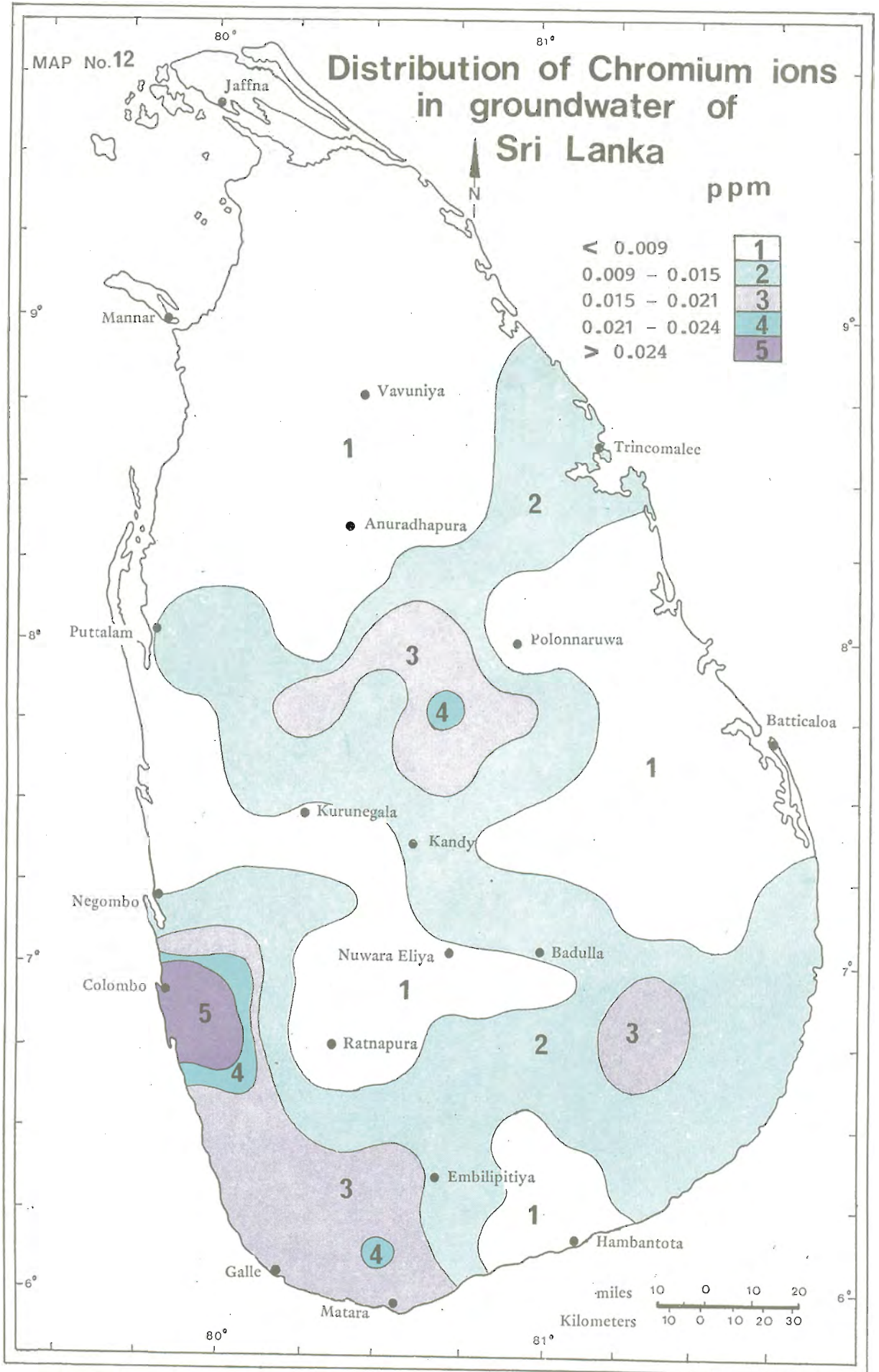
MAP No.12

Distribution of Chromium ions in groundwater of Sri Lanka

ppm

- < 0.009
- 0.009 - 0.015
- 0.015 - 0.021
- 0.021 - 0.024
- > 0.024

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |

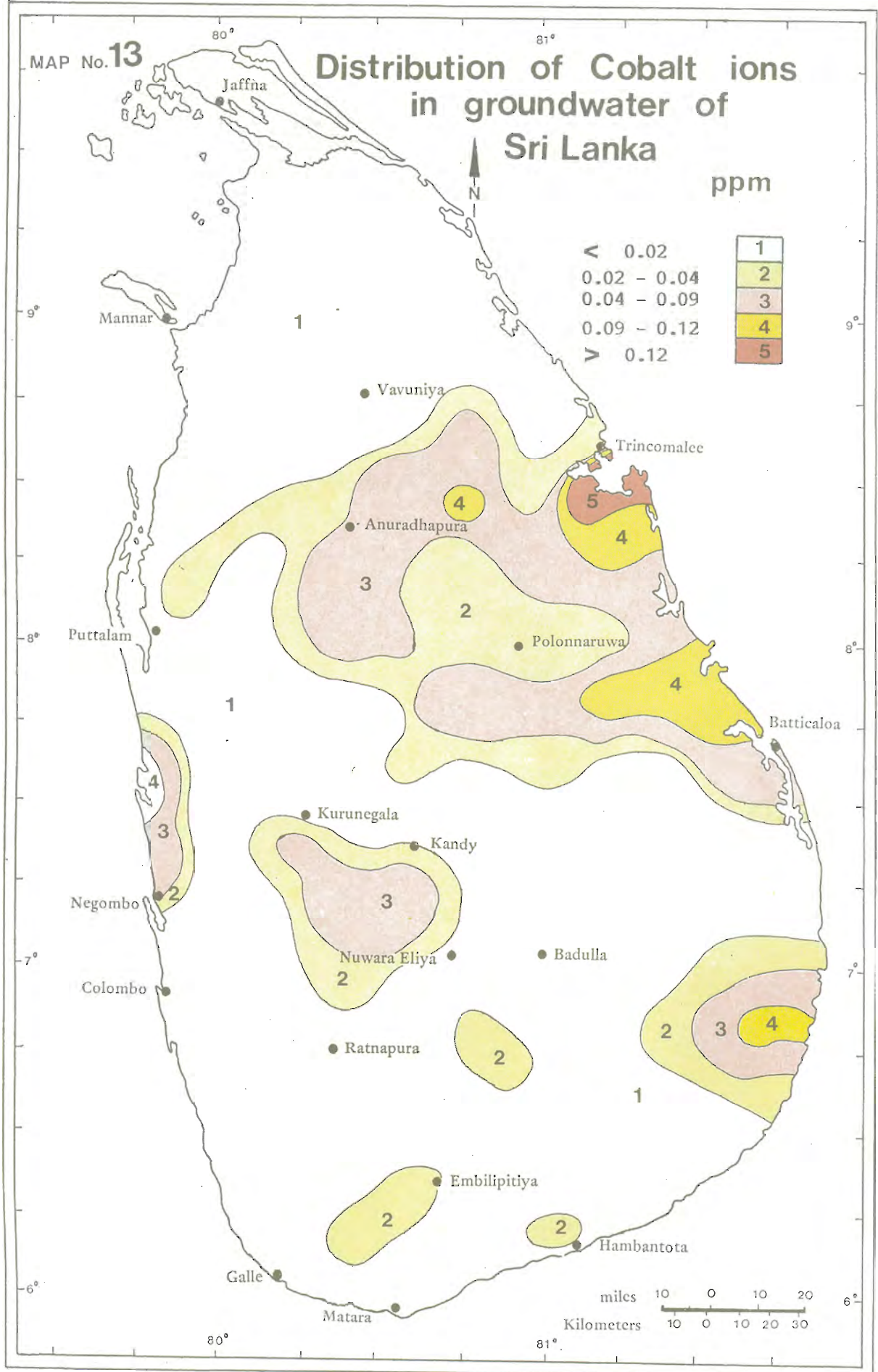


MAP No. 13

Distribution of Cobalt ions in groundwater of Sri Lanka

ppm

| | |
|-------------|---|
| < 0.02 | 1 |
| 0.02 - 0.04 | 2 |
| 0.04 - 0.09 | 3 |
| 0.09 - 0.12 | 4 |
| > 0.12 | 5 |

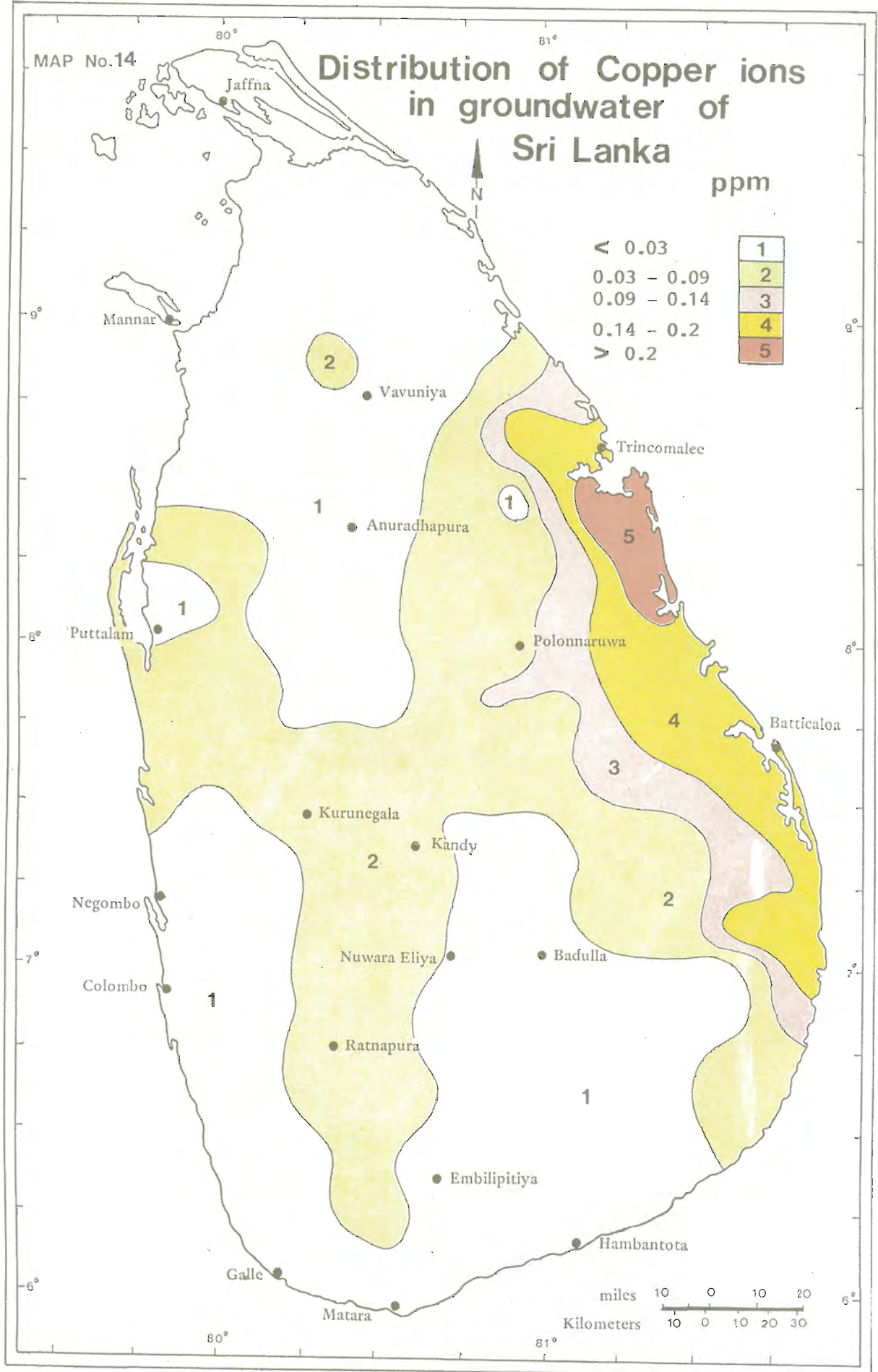


MAP No.14

Distribution of Copper ions in groundwater of Sri Lanka

ppm

- < 0.03
- 0.03 - 0.09
- 0.09 - 0.14
- 0.14 - 0.2
- > 0.2

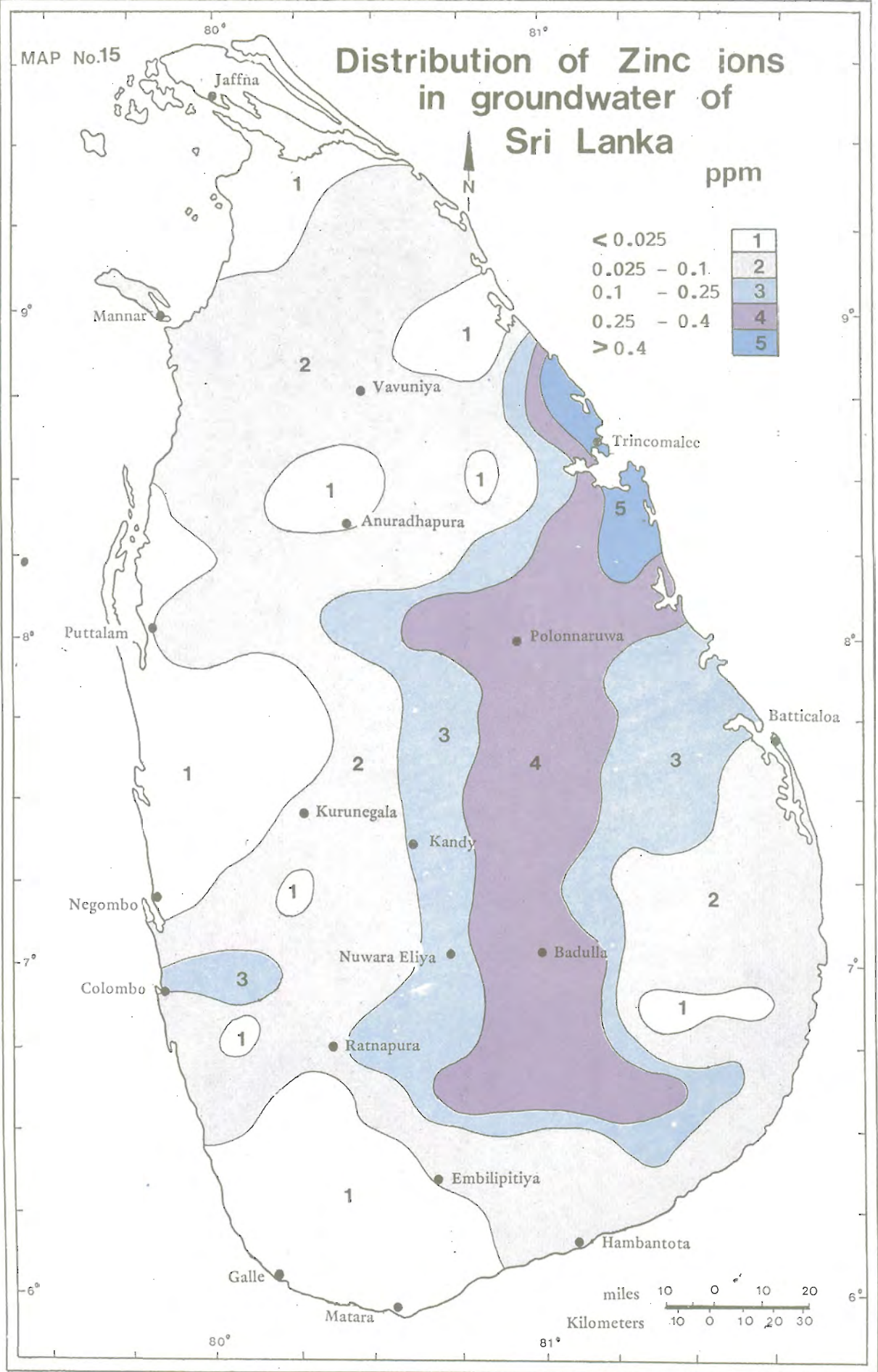


MAP No.15

Distribution of Zinc ions in groundwater of Sri Lanka

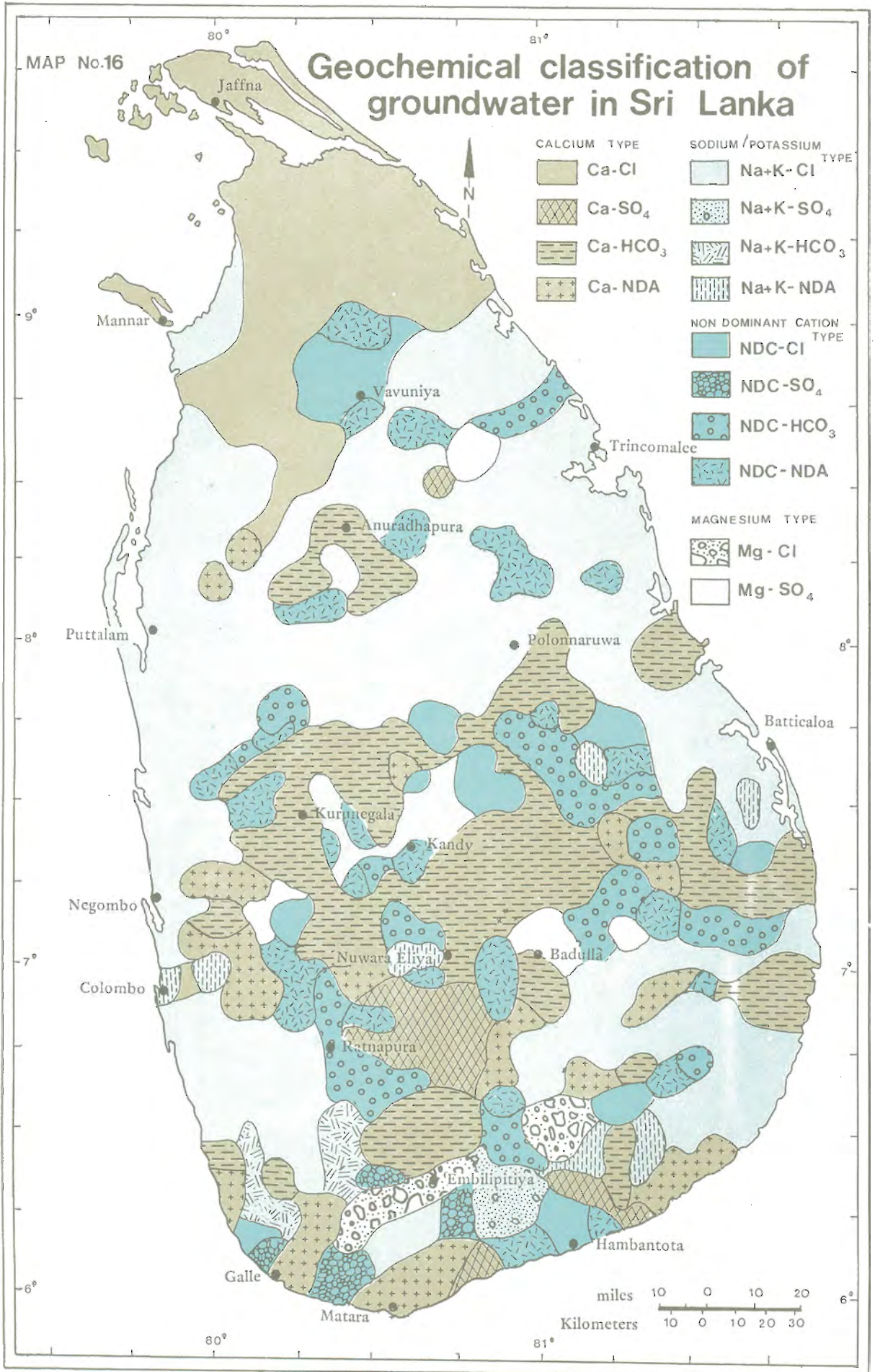
ppm

| | |
|-------------|---|
| < 0.025 | 1 |
| 0.025 - 0.1 | 2 |
| 0.1 - 0.25 | 3 |
| 0.25 - 0.4 | 4 |
| > 0.4 | 5 |



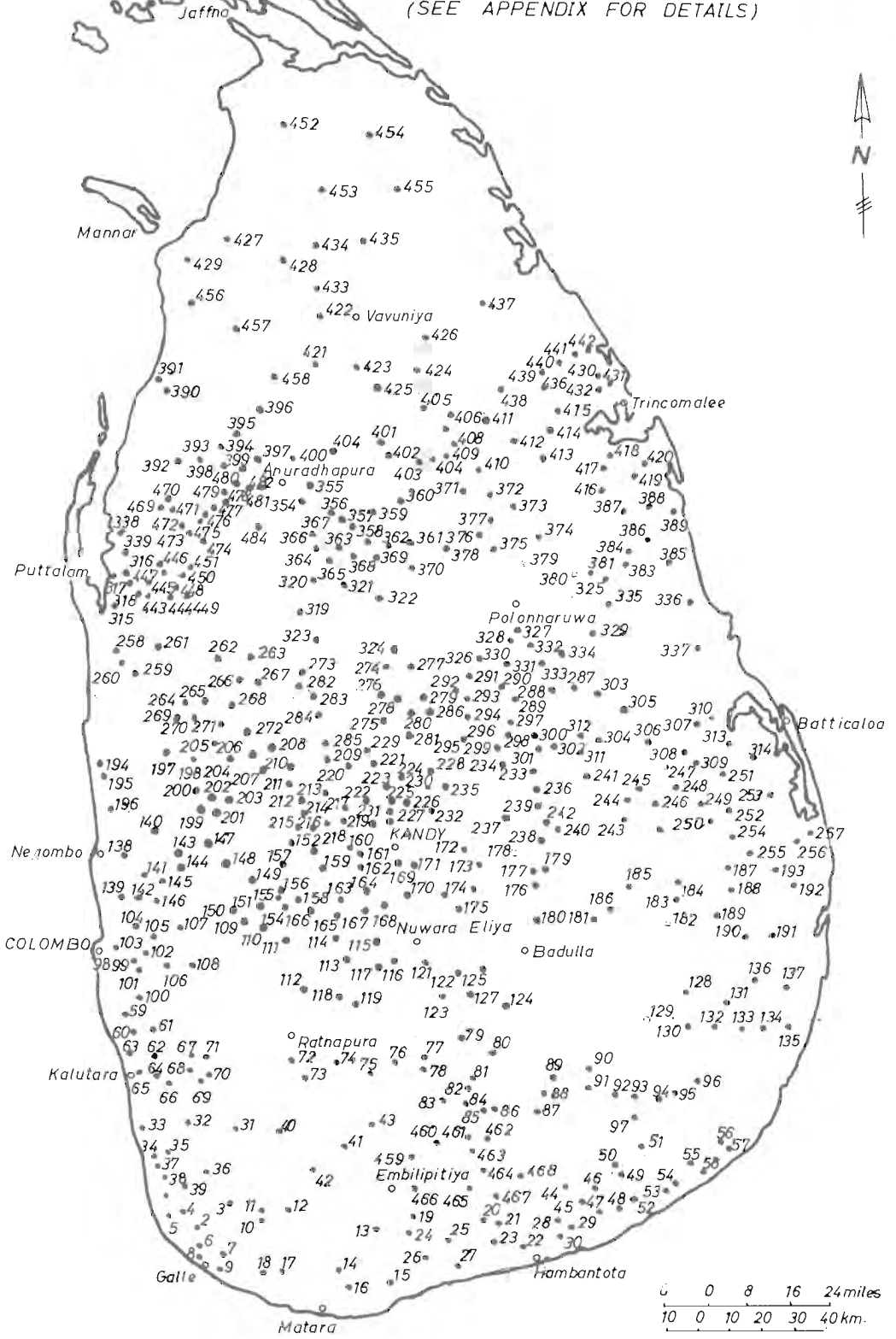
MAP No.16

Geochemical classification of groundwater in Sri Lanka



SAMPLE LOCATION MAP

(SEE APPENDIX FOR DETAILS)



APPENDIX

Chemical Results of the Sampled Well Water: Ca - Cl Subgroup

| Location No. | Ca | Mg | Na | K | HCO ₃ | SO ₄ | Cl | TDS | Total Hardness CaCO ₃ | Total Fe | Min | Total Cr | Total Co | Total V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | SiO ₂ | F | Topographic Sheet |
|--------------|--------|-------|--------|--------|------------------|-----------------|---------|------|-------------------------------------|----------|-----|----------|----------|---------|-----|-----|-----------------|-----------------|-----------------|------------------|-------|-------------------|
| | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm in CaCO ₃ | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppm | ppb | |
| 33 | 60.33 | 5.55 | 2.29 | 20.14 | 61.0 | 44.18 | 70.00 | 195 | 164 | 2700 | 100 | 12 | 2 | 1 | 10 | 3 | 21,000 | 28 | 79 | 21 | 140 | Alutgama |
| 86 | 6.00 | 1.21 | 2.84 | 3.51 | 12.8 | 3.36 | 11.00 | 112 | 27 | 110 | 42 | 17 | 7 | 8 | 20 | 217 | 500 | 111 | 11 | 14 | 700 | Haputale |
| 88 | 6.51 | 2.43 | 1.14 | 0.39 | 15.2 | 0.48 | 11.69 | 59 | 21 | 110 | 62 | 12 | 1 | 26 | 7 | 218 | 10 | 110 | 7 | 12 | 200 | " |
| 92 | 39.87 | 12.15 | 13.33 | 11.73 | 25.0 | 4.32 | 119.81 | 120 | 150 | 110 | nd | 2 | 17 | 4 | 13 | 217 | 3,000 | 310 | 12 | 2 | 2,000 | Buttala |
| 100 | 20.04 | 0.04 | 12.85 | 15.64 | 43.9 | 0.43 | 41.99 | 101 | 52 | 3200 | 72 | 22 | 17 | 07 | 10 | 170 | 2,000 | 70 | 12 | 2 | 40 | Avissawella |
| 104 | 20.04 | 0.14 | 7.86 | 7.82 | 43.9 | 0.04 | 32.99 | 112 | 56 | 3200 | 73 | 20 | 1 | 3 | 12 | 120 | 6,000 | 122 | 11 | 8 | 430 | " |
| 117 | 20.04 | 8.48 | 1.52 | 0.39 | 19.5 | 0.33 | 41.99 | 103 | 85 | 1110 | 21 | 7 | 2 | 2 | 10 | 17 | 3,100 | 127 | 11 | 11 | 300 | Hartton |
| 197 | 88.07 | 12.10 | 45.98 | 31.68 | 183.0 | 1.33 | 170.00 | 300 | 270 | 3110 | 72 | 7 | 1 | 3 | 19 | 9 | 8,400 | 112 | 12 | 1 | 70 | Dandagamuwa |
| 273 | 100.20 | 12.08 | 45.97 | 5.86 | 128.7 | 5.25 | 210.00 | 850 | 300 | 70 | 100 | 12 | 10 | 7 | 32 | 22 | 4,600 | 10 | 312 | 12 | 40 | Nalanda |
| 404 | 220.00 | 3.68 | 68.96 | 67.26 | 348.9 | 4.80 | 460.00 | 920 | 700 | 1330 | 20 | 2 | 37 | 31 | 17 | 17 | 2,000 | 28 | 17 | 37 | 700 | Medawachechiya |
| 421 | 208.00 | 9.72 | 10.80 | 35.97 | 427.0 | 4.41 | 420.00 | 1700 | 920 | 170 | 27 | 3 | 1 | 7 | 21 | 28 | 2,000 | 22 | 627 | 41 | 750 | Vavuniya |
| 428 | 208.00 | 4.86 | 522.52 | 278.45 | 572.9 | 4.80 | 1200.00 | 1500 | 720 | 400 | 17 | 7 | 3 | 11 | 17 | 31 | 110 | 17 | 175 | 73 | 500 | Mantai |
| 442 | 260.50 | 11.91 | 183.90 | 28.94 | 616.8 | 47.07 | 412.00 | 1011 | 700 | 400 | 17 | 11 | 8 | 1 | 125 | 80 | 1200 | 12 | 137 | 31 | 2800 | Padaviya |
| 452 | 260.50 | 11.91 | 344.82 | 283.92 | 446.6 | 34.58 | 1000.00 | 2200 | 700 | 400 | 82 | 2 | 11 | 20 | 21 | 21 | 10,610 | 120 | 175 | 75 | 1500 | Tunikkai |
| 453 | 320.60 | 11.91 | 413.79 | 237.38 | 427.0 | 5.76 | 1200.00 | 2107 | 850 | 170 | 35 | 7 | 27 | 11 | 19 | 34 | nd | 72 | 175 | 60 | 500 | Iranamadu |
| 454 | 200.40 | 11.91 | 275.86 | 228.35 | 305.0 | 15.36 | 1010.00 | 2100 | 810 | 700 | 30 | 3 | 2 | 12 | 14 | 37 | nd | 90 | 170 | 75 | 1000 | " |
| 455 | 240.40 | 97.00 | 551.72 | 403.98 | 610.1 | 15.36 | 1560.00 | 4100 | 1000 | 170 | 30 | 2 | 7 | 1 | 13 | 32 | nd | 91 | 100 | 60 | 750 | " |
| 456 | 220.00 | 60.78 | 206.89 | 185.71 | 305.0 | 240.13 | 700.00 | 1512 | 800 | 460 | 17 | 2 | 1 | 1 | 20 | 28 | 200 | 30 | 17 | 92 | 500 | Murunkan |
| 457 | 200.40 | 97.00 | 758.62 | 438.40 | 610.1 | 96.06 | 1780.00 | 1500 | 900 | 640 | 22 | 2 | 2 | 3 | 10 | 45 | 1,000 | 17 | 27 | 37 | 750 | " |
| 458 | 308.31 | 72.93 | 857.58 | 177.12 | 610.1 | 18.25 | 1920.00 | 1600 | 820 | 820 | 27 | 1 | 3 | 7 | 15 | 27 | 1,200 | 27 | 21 | 19 | 1000 | " |
| 483 | 76.75 | 24.31 | 27.58 | 15.64 | 60.3 | 63.40 | 169.00 | 320 | 290 | 800 | 74 | 3 | 1 | 1 | 32 | 28 | 1,700 | 120 | 102 | 22 | 321 | Kala Oya |

Chemical Results of the Sampled Well Water: Ca - SO₄ Subgroup

| | | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|-------|-------|-------|--------|-------|------|-----|------|-----|----|-----|-----|----|-----|-------|-----|----|----|-----|--------------|
| 26 | 120.08 | 40.08 | 45.97 | 29.33 | 183.0 | 344.75 | 20.00 | 430 | 400 | 3200 | 122 | 7 | 4 | 20 | 6 | 22 | 110 | 38 | 32 | 31 | 100 | Ambalantota |
| 76 | 60.32 | 6.68 | 28.25 | 7.63 | 60.4 | 144.09 | 27.00 | 272 | 178 | 870 | 94 | 10 | 7 | 17 | 51 | 100 | 7,000 | 27 | 11 | 7 | 400 | Ratnapura |
| 120 | 6.09 | 0.01 | 5.6 | 3.91 | 0.5 | 12.96 | 7.00 | 114 | 57 | 1100 | 20 | 7 | 1 | 1 | 61 | 280 | 700 | 900 | 10 | 22 | 190 | Hartton |
| 126 | 20.04 | 2.41 | 2.29 | 2.69 | 19.5 | 3.41 | 12.00 | 118 | 60 | 110 | 21 | 3 | 3 | 2 | 10 | 317 | 5,900 | 117 | 7 | 18 | 20 | Nuwara Eliya |
| 407 | 218.83 | 3.73 | 25.51 | 35.97 | 361.1 | 46.68 | 20.00 | 1500 | 700 | 170 | 24 | 2 | 122 | 117 | 10 | 22 | 210 | 27 | 32 | 22 | 700 | Horowpataana |

Chemical Results of the Sampled Well Water: Ca - HCO₃ Subgroup

| Loca- tion No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCO ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hard- ness ppm in CaCO ₃ | Total Fe ppb | Total Mn ppb | Total Cr ppb | Total Co ppb | Total V ppb | Cu ppb | Zn ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SiO ₂ ppm | F ppb | Topographic Sheet |
|----------------------|-----------|-----------|-----------|----------|-------------------------|------------------------|-----------|------------|--|-----------------|-----------------|-----------------|-----------------|----------------|-----------|-----------|------------------------|------------------------|------------------------|-------------------------|----------|----------------------|
| 34 | 80.16 | 19.97 | 2.29 | 30.73 | 226.9 | 101.34 | 2.00 | 301 | 250 | 2900 | 112 | 12 | 1 | 28 | 11 | 13 | 11,000 | 28 | 62 | 27 | 100 | Alutgama |
| 35 | 80.16 | 21.37 | 2.29 | 28.74 | 263.5 | 53.31 | 16.85 | 142 | 254 | 2710 | 114 | 18 | 1 | 27 | 22 | 12 | 10,000 | 18 | 76 | 45 | 110 | " |
| 36 | 100.20 | 2.70 | 2.29 | 15.17 | 268.4 | 20.17 | 29.00 | 38 | 257 | 2170 | 78 | 13 | 1 | 17 | 10 | 7 | 12,000 | 70 | 7 | 47 | 100 | " |
| 41 | 6.80 | 2.66 | 0.22 | 1.42 | 26.2 | 4.80 | 1.77 | 38 | 28 | 2000 | 38 | 14 | 30 | 3 | 20 | 9 | 3,700 | 111 | 2 | 2 | 200 | Rakwana |
| 43 | 20.04 | 5.31 | 0.22 | 0.39 | 67.4 | 4.80 | 8.99 | 292 | 72 | 3720 | 34 | 13 | 32 | 2 | 15 | 18 | 5,000 | 110 | 1 | 8 | 500 | " |
| 45 | 220.00 | 120.00 | 2.29 | 28.63 | 738.8 | 207.49 | 49.00 | 1000 | 850 | 110 | 128 | 3 | 1 | 112 | 12 | 18 | 780 | 28 | 96 | 22 | 770 | Katragama |
| 46 | 60.12 | 12.34 | 2.29 | 31.59 | 164.7 | 48.51 | 29.00 | 181 | 181 | 700 | 111 | 1 | 3 | 122 | 13 | 22 | 510 | 28 | 17 | 37 | 720 | " |
| 53 | 81.00 | 12.09 | 0.01 | 1.95 | 189.7 | 83.18 | 10.00 | 254 | 254 | 110 | 75 | 2 | 1 | 150 | 10 | 71 | 100 | 100 | 92 | 31 | 720 | " |
| 78 | 9.41 | 1.32 | 0.24 | 0.39 | 26.2 | 10.02 | 2.00 | 32 | 17 | 110 | 90 | 12 | 7 | 7 | 7 | 7 | 3,000 | 18 | 22 | 8 | 370 | Haputale |
| 102 | 20.04 | 7.96 | 0.22 | 0.43 | 71.9 | 0.96 | 17.00 | 142 | 83 | 3160 | 74 | 30 | 11 | 22 | 4 | 210 | 3,000 | 73 | 12 | 3 | 510 | Awissawella |
| 114 | 20.04 | 0.02 | 4.33 | 3.91 | 56.7 | 0.86 | 7.00 | 102 | 51 | 720 | 45 | 11 | 1 | 2 | 60 | 17 | 3,700 | 413 | 11 | 11 | 200 | Hatton |
| 121 | 20.04 | 10.67 | 2.29 | 3.12 | 61.0 | 4.46 | 1.99 | 119 | 94 | 80 | 19 | 8 | 22 | 1 | 17 | 172 | 22,000 | 175 | 9 | 37 | 20 | Nuwara Eliya |
| 122 | 22.81 | 6.07 | 8.94 | 3.91 | 73.2 | 3.30 | 7.00 | 129 | 83 | 270 | 20 | 7 | 23 | 2 | 22 | 217 | 20,000 | 220 | 3 | 32 | 10 | " |
| 124 | 20.04 | 1.44 | 13.79 | 3.33 | 55.5 | 1.58 | 20.00 | 114 | 56 | 80 | 22 | 2 | 3 | 7 | 22 | 337 | 10,000 | 412 | 3 | 3 | 10 | " |
| 134 | 151.00 | 36.46 | 68.96 | 35.43 | 549.1 | 4.41 | 170.00 | 1800 | 541 | 270 | 81 | 5 | 22 | 22 | 92 | 22 | 110 | 110 | 60 | 40 | 220 | Poruvil |
| 137 | 156.00 | 12.15 | 22.98 | 0.46 | 244.0 | 0.52 | 119.85 | 1700 | 170 | 300 | 77 | 14 | 17 | 17 | 12 | 41 | 210 | 73 | 90 | 37 | 320 | " |
| 143 | 60.12 | 4.83 | 1.60 | 0.59 | 121.0 | 3.42 | 27.00 | 203 | 200 | 2120 | 17 | 9 | 2 | 27 | 2 | 92 | 22,000 | 41 | 11 | 2 | 500 | Gampaha |
| 151 | 40.68 | 4.10 | 13.89 | 2.34 | 122.0 | 3.45 | 10.00 | 150 | 112 | 3000 | 21 | 22 | 1 | 1 | 40 | 27 | 2,100 | 80 | 7 | 7 | 700 | " |
| 154 | 60.12 | 15.68 | 22.98 | 14.66 | 244.0 | 34.19 | 33.99 | 170 | 215 | 1220 | 80 | 8 | 17 | 17 | 60 | 12 | 70 | 110 | 1000 | 17 | 80 | Kandy |
| 155 | 80.16 | 3.10 | 20.04 | 3.91 | 250.1 | 29.77 | 18.00 | 213 | 220 | 720 | 70 | 7 | 117 | 42 | 70 | 17 | 310 | 57 | 1750 | 7 | 20 | " |
| 157 | 60.12 | 16.97 | 7.40 | 11.73 | 227.9 | 44.18 | 7.00 | 220 | 220 | 2120 | 95 | 2 | 110 | 3 | 60 | 10 | 350 | 111 | 1200 | 2 | 70 | " |
| 158 | 80.16 | 4.81 | 6.89 | 3.71 | 244.0 | 19.02 | 13.99 | 820 | 220 | 820 | 92 | 3 | 17 | 2 | 71 | 12 | 1,320 | 17 | 780 | 11 | 80 | " |
| 159 | 80.16 | 2.32 | 5.43 | 0.08 | 250.1 | 4.61 | 9.95 | 210 | 210 | 710 | 70 | 5 | 173 | 7 | 70 | 17 | 7,480 | 213 | 172 | 13 | 90 | " |
| 160 | 60.12 | 12.10 | 7.58 | 0.35 | 183.0 | 47.83 | 11.99 | 810 | 290 | 810 | 70 | 12 | 27 | 1 | 71 | 81 | 10,000 | 72 | 370 | 14 | 90 | " |
| 161 | 64.00 | 36.46 | 2.29 | 0.50 | 311.1 | 52.53 | 3.99 | 190 | 310 | 820 | 100 | 1 | 32 | 27 | 70 | 22 | 10 | 120 | 270 | 3 | 10 | " |
| 162 | 60.12 | 7.73 | 2.29 | 2.16 | 183.0 | 32.61 | 3.99 | 182 | 182 | 700 | 90 | 6 | 112 | 48 | 72 | 22 | 7,000 | 720 | 470 | 2 | 100 | " |
| 163 | 40.08 | 6.04 | 9.19 | 0.74 | 122.0 | 25.02 | 13.99 | 120 | 125 | 2200 | 80 | 1 | 28 | 22 | 69 | 42 | 3,000 | 17 | 440 | 10 | 10 | " |
| 165 | 40.08 | 18.92 | 16.09 | 0.66 | 183.0 | 34.10 | 20.00 | 70 | 177 | 1720 | 60 | 12 | 22 | 27 | 72 | 10 | 310 | 22 | 121 | 2 | 100 | " |
| 166 | 80.15 | 4.80 | 11.49 | 1.56 | 244.0 | 34.97 | 15.00 | 720 | 220 | 720 | 75 | 9 | 173 | 10 | 73 | 17 | 1,320 | 70 | 127 | 3 | 100 | " |

Cont: Ca - HCO₃ Subgroup

| | | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|-------|-------|-------|-------|-------|------|-----|------|-----|----|-----|-----|-----|-----|--------|-----|------|-----|------|--------------|
| 168 | 62.32 | 2.43 | 22.98 | 11.63 | 298.9 | 44.18 | 20.99 | 110 | 256 | 1000 | 20 | 11 | 43 | 10 | 44 | 212 | 7,500 | 12 | 310 | 10 | 100 | Kandy |
| 169 | 40.08 | 7.74 | 9.19 | 1.07 | 122.0 | 32.18 | 13.99 | 180 | 132 | 2700 | 42 | 7 | 141 | 7 | 45 | 111 | 8,000 | 70 | 331 | 1 | 100 | " |
| 170 | 60.12 | 12.10 | 22.98 | 1.79 | 163.0 | 46.58 | 38.00 | 70 | 200 | 770 | 70 | 7 | 142 | 3 | 40 | 71 | 2,000 | 27 | 127 | 7 | 150 | " |
| 171 | 40.08 | 5.32 | 6.89 | 1.34 | 122.0 | 23.53 | 9.99 | 200 | 122 | 7000 | 90 | 3 | 17 | 2 | 42 | 200 | 1,000 | 78 | 140 | 8 | 120 | " |
| 172 | 20.04 | 9.41 | 1.83 | 0.71 | 61.0 | 39.38 | 1.99 | 122 | 89 | 2100 | 210 | 12 | 3 | 4 | 37 | 317 | 2,000 | 70 | 60 | 14 | 20 | Hanguranketa |
| 173 | 40.08 | 5.29 | 0.45 | 2.00 | 107.5 | 44.18 | 1.99 | 122 | 122 | 1700 | 72 | 12 | 13 | 14 | 20 | 410 | 3,000 | 27 | 128 | 40 | 170 | " |
| 175 | 60.12 | 4.82 | 10.12 | 17.20 | 183.0 | 19.06 | 17.58 | 170 | 170 | 2120 | 172 | 17 | 3 | 117 | 12 | 317 | 200 | 70 | 420 | 112 | 320 | " |
| 176 | 100.00 | 12.08 | 45.97 | 7.23 | 304.0 | 96.06 | 41.98 | 300 | 300 | 700 | 43 | 14 | 2 | 312 | 12 | 218 | 1,200 | 72 | 440 | 11 | 100 | " |
| 177 | 40.08 | 2.40 | 22.98 | 15.01 | 128.1 | 34.58 | 17.00 | 121 | 110 | 110 | 72 | 15 | 4 | 412 | 13 | 320 | 7,100 | 74 | 312 | 111 | 990 | " |
| 178 | 60.12 | 4.82 | 22.98 | 3.20 | 183.0 | 34.58 | 27.00 | 117 | 170 | 1100 | 45 | 10 | 42 | 1 | 17 | 327 | 3,000 | 12 | 127 | 22 | 120 | " |
| 179 | 42.08 | 3.61 | 22.98 | 4.25 | 128.1 | 34.58 | 27.99 | 200 | 120 | 120 | 43 | 10 | 42 | 1 | 17 | 327 | 3,000 | 12 | 127 | 22 | 120 | " |
| 187 | 86.16 | 9.10 | 22.98 | 32.05 | 250.7 | 2.79 | 69.99 | 470 | 238 | 170 | 70 | 2 | 4 | 72 | 173 | 27 | 700 | 120 | 320 | 110 | 320 | Tirrukovil |
| 188 | 100.00 | 5.30 | 6.62 | 7.82 | 305.0 | 1.59 | 71.99 | 500 | 272 | 120 | 112 | 3 | 2 | 7 | 42 | 28 | 800 | 320 | 1000 | 12 | 1500 | " |
| 192 | 120.24 | 24.10 | 22.98 | 6.41 | 427.0 | 4.31 | 37.00 | 540 | 400 | 130 | 102 | 12 | 7 | 33 | 170 | 72 | 200 | 227 | 2700 | 17 | 2300 | " |
| 200 | 60.12 | 4.80 | 45.98 | 2.74 | 183.0 | 0.81 | 80.00 | 175 | 170 | 620 | 77 | 67 | 40 | 1 | 12 | 22 | 9,200 | 22 | 17 | 1 | 90 | Dandagamuwa |
| 201 | 60.12 | 5.50 | 16.18 | 3.91 | 147.6 | 3.88 | 59.99 | 170 | 172 | 120 | 81 | 4 | 42 | 1 | 13 | 21 | 6,000 | 17 | 43 | 2 | 10 | " |
| 202 | 50.12 | 5.30 | 22.99 | 38.33 | 183.0 | 2.79 | 60.00 | 200 | 173 | 170 | 82 | 17 | 27 | 3 | 11 | 17 | 6,400 | 77 | 41 | 11 | 620 | " |
| 203 | 50.12 | 1.16 | 22.99 | 7.43 | 183.0 | 2.79 | 19.99 | 200 | 155 | 110 | 85 | 3 | 31 | 2 | 19 | 22 | 1,000 | 27 | 24 | 3 | 730 | " |
| 206 | 40.08 | 7.22 | 22.99 | 9.38 | 142.1 | 1.34 | 50.00 | 200 | 120 | 430 | 62 | 2 | 17 | 1 | 22 | 30 | 7,000 | 7 | 71 | 3 | 120 | " |
| 207 | 40.08 | 6.51 | 22.99 | 5.08 | 122.0 | 2.09 | 40.00 | 250 | 127 | 200 | 75 | 7 | 22 | 1 | 29 | 22 | 8,500 | 7 | 13 | 4 | 190 | " |
| 208 | 40.08 | 8.92 | 10.11 | 15.64 | 123.0 | 2.86 | 30.00 | 158 | 137 | 560 | 60 | 3 | 17 | 1 | 27 | 31 | 10,000 | 3 | 27 | 2 | 300 | " |
| 211 | 40.08 | 4.81 | 23.91 | 0.78 | 122.0 | 1.24 | 39.99 | 170 | 120 | 880 | 67 | 12 | 1 | 17 | 20 | 27 | 11,000 | 417 | 17 | 3 | 100 | Kurunegala |
| 214 | 60.12 | 5.28 | 9.88 | 15.64 | 183.0 | 1.63 | 29.99 | 170 | 172 | 720 | 64 | 7 | 117 | 20 | 52 | 34 | 7,200 | 317 | 127 | 2 | 200 | " |
| 221 | 40.08 | 3.13 | 2.29 | 29.21 | 122.0 | 12.39 | 30.00 | 170 | 113 | 770 | 58 | 7 | 1 | 22 | 53 | 28 | 4,000 | 713 | 31 | 8 | 40 | " |
| 230 | 40.08 | 12.12 | 2.29 | 18.77 | 115.9 | 53.31 | 20.00 | 170 | 97 | 770 | 43 | 5 | 7 | 2 | 72 | 74 | 10,000 | 22 | 17 | 11 | 10 | " |
| 231 | 40.08 | 4.83 | 2.29 | 29.21 | 122.0 | 19.11 | 30.63 | 170 | 97 | 750 | 40 | 5 | 3 | 2 | 71 | 75 | 10,000 | 21 | 22 | 12 | 10 | " |
| 232 | 60.42 | 34.31 | 22.98 | 7.23 | 286.7 | 63.40 | 17.00 | 150 | 266 | 820 | 41 | 17 | 3 | 412 | 13 | 341 | 300 | 78 | 141 | 21 | 20 | Rangala |
| 233 | 74.45 | 12.15 | 2.29 | 19.12 | 244.0 | 34.10 | 20.99 | 120 | 236 | 910 | 42 | 7 | 17 | 312 | 17 | 313 | 270 | 17 | 114 | 2 | 130 | " |
| 234 | 20.04 | 1.20 | 2.29 | 6.41 | 61.0 | 4.32 | 9.00 | 170 | 55 | 880 | 70 | 14 | 1 | 217 | 37 | 337 | 10 | 29 | 52 | 3 | 290 | " |
| 236 | 100.02 | 2.61 | 2.29 | 18.92 | 263.5 | 48.03 | 17.00 | 261 | 261 | 720 | 90 | 3 | 3 | 412 | 21 | 412 | 880 | 28 | 142 | 7 | 90 | " |
| 237 | 140.28 | 9.87 | 2.29 | 6.25 | 415.4 | 44.18 | 11.99 | 291 | 291 | 720 | 74 | 2 | 1 | 313 | 10 | 320 | 1,000 | 74 | 54 | 4 | 170 | " |
| 238 | 68.82 | 24.31 | 2.29 | 39.10 | 300.1 | 48.03 | 17.00 | 272 | 272 | 710 | 92 | 1 | 1 | 117 | 20 | 317 | 1,000 | 120 | 42 | 32 | 270 | " |
| 239 | 100.20 | 4.55 | 2.29 | 26.07 | 305.0 | 18.01 | 27.00 | 269 | 269 | 620 | 92 | 3 | 1 | 312 | 10 | 217 | 920 | 70 | 43 | 3 | 90 | " |
| 240 | 80.86 | 12.15 | 22.98 | 0.04 | 298.0 | 35.06 | 21.99 | 252 | 252 | 110 | 90 | 2 | 3 | 412 | 17 | 218 | 620 | 170 | 47 | 31 | 190 | " |
| 244 | 68.01 | 36.46 | 0.22 | 0.39 | 311.7 | 44.18 | 11.99 | 1200 | 320 | 770 | 110 | 8 | 1 | 17 | 74 | 115 | 200 | 920 | 427 | 27 | 130 | Maha Oya |

Cont.; Ca - HCO₃ Subgroups

| 246 | 40.08 | 24.19 | 0.22 | 302.6 | 20.17 | 21.99 | 720 | 300 | 150 | 117 | 13 | 13 | 62 | 21 | 113 | 400 | 470 | 528 | 4 | 20 | Topographic Sheet | |
|-----|--------|--------|--------|-------|-------|--------|-----|-----|------|-----|----|----|-----|-----|-----|--------|--------|-----|-----|-------|-------------------|--------------|
| 248 | 120.24 | 4.78 | 2.29 | 24.32 | 329.0 | 41.99 | 320 | 320 | 700 | 120 | 17 | 17 | 27 | 88 | 317 | 100 | 737 | 422 | 3 | 320 | Maha Oya | |
| 250 | 70.03 | 243.31 | 2.29 | 0.25 | 272.0 | 10.00 | 700 | 290 | 620 | 120 | 10 | 10 | 17 | 61 | 172 | 9,200 | 477 | 412 | 17 | 370 | " | |
| 251 | 220.20 | 12.15 | 45.97 | 9.19 | 616.8 | 84.38 | 420 | 600 | 440 | 120 | 4 | 4 | 42 | 51 | 72 | 5,000 | 112 | 270 | 2 | 620 | Kalmunai | |
| 257 | 148.11 | 24.31 | 413.79 | 12.90 | 385.0 | 53.40 | 700 | 470 | 110 | 70 | 3 | 3 | 41 | 120 | 74 | 5,300 | 140 | 270 | 27 | 300 | " | |
| 268 | 80.16 | 4.08 | 22.08 | 23.62 | 250.7 | 61.04 | 412 | 217 | 630 | 120 | 15 | 15 | 13 | 7 | 27 | 5,000 | 512 | 18 | 2 | 570 | Wariyapola | |
| 279 | 40.08 | 4.09 | 22.98 | 9.38 | 122.6 | 39.63 | 317 | 117 | 400 | 122 | 7 | 7 | 11 | 41 | 19 | 1,000 | 522 | 12 | 8 | 500 | " | |
| 276 | 96.05 | 24.31 | 2.29 | 29.17 | 206.2 | 85.49 | 520 | 340 | 130 | 74 | 20 | 20 | 42 | 39 | 17 | 6,000 | 21 | 312 | 30 | 130 | Nalanda | |
| 280 | 128.11 | 12.15 | 2.98 | 33.63 | 285.0 | 113.94 | 370 | 370 | 810 | 80 | 20 | 20 | 7 | 42 | 72 | 4,600 | 26 | 512 | 17 | 170 | " | |
| 282 | 40.08 | 12.13 | 2.29 | 3.91 | 128.7 | 34.61 | 350 | 150 | 20 | 120 | 22 | 22 | 17 | 32 | 17 | 9,200 | 22 | 312 | 17 | 20 | " | |
| 284 | 80.16 | 2.38 | 2.29 | 34.61 | 194.9 | 63.46 | 370 | 210 | 70 | 120 | 21 | 21 | 12 | 38 | 121 | 9,400 | 21 | 532 | 23 | 30 | " | |
| 285 | 80.16 | 4.80 | 2.29 | 34.10 | 224.0 | 44.27 | 350 | 220 | 80 | 140 | 22 | 22 | 27 | 7 | 42 | 4,600 | 22 | 737 | 21 | 70 | " | |
| 290 | 100.20 | 12.00 | 0.22 | 0.39 | 199.1 | 105.18 | 390 | 300 | 210 | 20 | 10 | 10 | 77 | 1 | 92 | 11,700 | 130 | 452 | 3 | 120 | Elahera | |
| 291 | 38.43 | 24.31 | 2.29 | 0.86 | 305.0 | 59.61 | 420 | 321 | 610 | 76 | 20 | 20 | 22 | 71 | 417 | 6,000 | 117 | 132 | 2 | 230 | " | |
| 292 | 60.12 | 5.03 | 2.29 | 7.27 | 147.0 | 63.46 | 395 | 175 | 310 | 73 | 20 | 20 | 7 | 71 | 217 | 700 | 113 | 437 | 1 | 270 | " | |
| 293 | 60.12 | 5.30 | 22.98 | 34.33 | 183.0 | 101.44 | 320 | 172 | 710 | 75 | 22 | 22 | 12 | 78 | 312 | 10,000 | 122 | 53 | 1 | 70 | " | |
| 296 | 96.79 | 24.31 | 2.29 | 25.10 | 305.0 | 87.98 | 400 | 342 | 270 | 121 | 22 | 22 | 1 | 62 | 320 | 10,000 | 142 | 123 | 6 | 7000 | " | |
| 297 | 84.02 | 24.31 | 2.29 | 24.24 | 377.8 | 63.46 | 390 | 360 | 110 | 122 | 14 | 14 | 7 | 82 | 412 | 3,100 | 47 | 417 | 7 | 2320 | " | |
| 298 | 97.66 | 24.31 | 22.98 | 10.55 | 372.7 | 37.50 | 410 | 341 | 110 | 100 | 10 | 10 | 8 | 7 | 61 | 2,700 | 52 | 312 | 1 | 320 | " | |
| 301 | 40.08 | 24.19 | 2.29 | 3.83 | 226.9 | 101.34 | 342 | 220 | 170 | 110 | 15 | 15 | 1 | 67 | 325 | 10 | 67 | 74 | 12 | 7000 | " | |
| 303 | 116.00 | 12.15 | 2.29 | 30.63 | 305.0 | 101.44 | 500 | 340 | 210 | 100 | 2 | 2 | 17 | 227 | 92 | 320 | 10 | 9 | 49 | 27 | 270 | Rukam |
| 312 | 140.20 | 12.03 | 68.96 | 13.35 | 433.8 | 47.55 | 427 | 310 | 210 | 120 | 10 | 10 | 22 | 732 | 97 | 430 | 18 | 27 | 17 | 3100 | " | |
| 325 | 120.24 | 2.35 | 91.95 | 15.72 | 372.1 | 53.31 | 700 | 210 | 70 | 70 | 12 | 12 | 32 | 122 | 418 | 110 | 42 | 18 | 8 | 7820 | Polonnaruwa | |
| 330 | 80.16 | 2.43 | 68.96 | 7.39 | 244.0 | 9.36 | 700 | 210 | 70 | 70 | 12 | 12 | 32 | 122 | 418 | 110 | 42 | 18 | 8 | 7820 | " | |
| 332 | 120.24 | 2.30 | 68.96 | 35.97 | 366.0 | 34.58 | 600 | 310 | 110 | 34 | 2 | 2 | 137 | 30 | 48 | 110 | 38 | 21 | 1 | 10000 | " | |
| 333 | 120.24 | 10.81 | 91.95 | 31.28 | 366.0 | 212.89 | 600 | 345 | 110 | 38 | 18 | 18 | 17 | 71 | 410 | 110 | 40 | 32 | 12 | 9780 | " | |
| 334 | 120.24 | 11.30 | 68.96 | 17.98 | 372.7 | 15.70 | 680 | 347 | 100 | 20 | 17 | 17 | 20 | 2 | 93 | 210 | 41 | 31 | 17 | 9780 | " | |
| 337 | 80.16 | 7.78 | 252.87 | 23.46 | 189.7 | 48.03 | 293 | 283 | 140 | 240 | 10 | 10 | 112 | 411 | 163 | 10,700 | 31 | 127 | 28 | 3720 | Vakaneri | |
| 355 | 80.16 | 7.29 | 2.29 | 28.94 | 244.0 | 44.66 | 386 | 230 | 1720 | 27 | 1 | 1 | 413 | 212 | 20 | 22 | 12,000 | 42 | 127 | 31 | 3400 | Anuradhapura |
| 356 | 140.28 | 0.40 | 2.29 | 16.81 | 427.0 | 5.28 | 653 | 352 | 3000 | 23 | 3 | 3 | 27 | 117 | 18 | 270 | 17 | 237 | 32 | 3800 | " | |
| 357 | 120.34 | 1.38 | 68.96 | 16.42 | 372.7 | 34.58 | 689 | 306 | 120 | 30 | 2 | 2 | 117 | 12 | 22 | 10 | 12,100 | 51 | 133 | 38 | 3200 | " |
| 358 | 120.24 | 19.32 | 45.97 | 28.94 | 427.0 | 24.59 | 442 | 380 | 110 | 21 | 2 | 2 | 27 | 17 | 21 | 6,000 | 22 | 147 | 31 | 3000 | " | |
| 359 | 100.20 | 4.25 | 91.95 | 5.47 | 311.7 | 15.33 | 460 | 268 | 610 | 22 | 3 | 3 | 28 | 22 | 23 | 12,000 | 27 | 132 | 37 | 2920 | " | |
| 361 | 140.24 | 23.23 | 68.96 | 14.07 | 488.1 | 13.36 | 657 | 447 | 70 | 25 | 17 | 17 | 22 | 28 | 18 | 820 | 17 | 162 | 17 | 400 | " | |
| 362 | 100.20 | 13.28 | 68.96 | 9.38 | 366.0 | 34.58 | 608 | 305 | 1000 | 21 | 11 | 11 | 27 | 13 | 21 | 720 | 92 | 337 | 11 | 600 | " | |
| 363 | 60.12 | 9.36 | 22.98 | 14.07 | 183.0 | 34.56 | 474 | 189 | 2000 | 22 | 10 | 10 | 22 | 12 | 29 | 4,000 | 95 | 920 | 30 | 700 | Anuradhapura | |
| 364 | 84.06 | 12.18 | 22.98 | 19.53 | 311.7 | 15.36 | 373 | 260 | 370 | 27 | 2 | 2 | 27 | 17 | 27 | 9,200 | 93 | 172 | 31 | 720 | " | |
| 366 | 80.16 | 6.68 | 45.97 | 9.77 | 244.0 | 26.41 | 354 | 228 | 270 | 24 | 7 | 7 | 111 | 27 | 17 | 180 | 110 | 37 | 415 | 21 | 410 | " |
| 368 | 160.32 | 1.36 | 68.96 | 28.94 | 494.8 | 15.36 | 659 | 406 | 110 | 320 | 20 | 20 | 117 | 14 | 42 | 400 | 43 | 413 | 17 | 5000 | " | |
| 369 | 160.32 | 2.33 | 45.97 | | 494.8 | 15.36 | 753 | 410 | 420 | 72 | 21 | 21 | 27 | 17 | 31 | 720 | 47 | 213 | 21 | 4070 | " | |

Chemical Results of the Sampled Well Water Ca - NDA Subgroup

| Lacation No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCO ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hardness ppm in CaCO ₃ | Total Fe ppm | Mn ppm | Total Cr ppm | Co ppm | Total V ppm | Cu ppm | Zn ppm | NO ₃ ppm | NO ₂ ppm | NH ₄ ppt | SiO ₂ ppm | F ppb | Topographic Sheet |
|--------------|--------|--------|--------|-------|----------------------|---------------------|--------|---------|---|--------------|--------|--------------|--------|-------------|--------|--------|---------------------|---------------------|---------------------|----------------------|-------|-------------------|
| 7 | 80.16 | 7.23 | 25.50 | 4.34 | 122.0 | 136.50 | 70.00 | 384 | 280 | 2730 | 12 | 21 | 17 | 7 | 11 | 18 | 7,000 | 18 | 81 | 47 | 40 | Ambalangoda |
| 8 | 63.64 | 12.16 | 21.20 | 4.34 | 122.0 | 29.60 | 22.10 | 298 | 209 | 3700 | 120 | 20 | 22 | 13 | 12 | 22 | 4,000 | 12 | 80 | 32 | 60 | " |
| 9 | 100.20 | 9.17 | 22.90 | 0.43 | 116.0 | 99.20 | 70.00 | 302 | 288 | 3000 | 110 | 23 | 21 | 2 | 17 | 23 | 7,000 | 22 | 78 | 11 | 80 | " |
| 10 | 108.07 | 24.31 | 22.90 | 3.56 | 183.0 | 196.10 | 50.00 | 340 | 370 | 2710 | 60 | 20 | 12 | 50 | 61 | 3 | 7,100 | 12 | 82 | 28 | 100 | Morawaka |
| 11 | 100.20 | 3.07 | 21.20 | 4.30 | 189.8 | 108.21 | 70.00 | 327 | 313 | 3000 | 63 | 22 | 12 | 40 | 36 | 3 | 7,000 | 21 | 87 | 27 | 60 | " |
| 15 | 88.02 | 36.47 | 22.90 | 0.39 | 128.8 | 187.30 | 90.00 | 410 | 370 | 7260 | 73 | 12 | 22 | 40 | 2 | 27 | 11,000 | 51 | 37 | 62 | 70 | Matara |
| 16 | 100.23 | 38.79 | 22.90 | 0.39 | 193.9 | 196.90 | 70.00 | 411 | 410 | 6000 | 70 | 27 | 17 | 28 | 17 | 13 | 11,000 | 72 | 17 | 67 | 20 | " |
| 37 | 40.08 | 4.76 | 2.30 | 31.36 | 91.5 | 27.41 | 38.00 | 170 | 112 | 2700 | 122 | 12 | 1 | 18 | 11 | 14 | 11,200 | 71 | 17 | 77 | 20 | Alutgama |
| 38 | 62.12 | 7.95 | 22.90 | 4.82 | 140.3 | 53.31 | 43.00 | 278 | 175 | 2190 | 160 | 17 | 1 | 100 | 11 | 11 | 11,000 | 27 | 101 | 77 | 20 | " |
| 39 | 62.12 | 8.75 | 2.30 | 3.29 | 104.9 | 34.61 | 44.12 | 180 | 172 | 3000 | 27 | 22 | 1 | 1 | 10 | 10 | 10,000 | 22 | 200 | 31 | 120 | " |
| 48 | 60.12 | 3.94 | 45.90 | 20.41 | 132.4 | 63.40 | 79.01 | 172 | 160 | 400 | 122 | 7 | 7 | 320 | 70 | 45 | 1,000 | 170 | 3 | 32 | 520 | Kataragama |
| 58 | 80.16 | 6.00 | 22.90 | 24.63 | 183.03 | 82.61 | 50.01 | 440 | 225 | 400 | 122 | 7 | 7 | 320 | 70 | 45 | 1,000 | 170 | 3 | 32 | 520 | Yala |
| 79 | 5.60 | 1.21 | 2.80 | 1.48 | 12.8 | 5.31 | 7.01 | 28 | 29 | 110 | 27 | 12 | 22 | 1 | 10 | 217 | 3,000 | 71 | 17 | 7 | 210 | Haputale |
| 82 | 8.80 | 1.21 | 5.70 | 1.56 | 12.8 | 10.11 | 13.11 | 40 | 27 | 110 | 41 | 2 | 2 | 17 | 10 | 218 | 900 | 21 | 11 | 1 | 400 | " |
| 89 | 8.80 | 0.12 | 1.60 | 0.39 | 12.8 | 0.52 | 11.12 | 47 | 127 | 80 | 43 | 20 | 17 | 21 | 9 | 417 | 1,000 | 110 | 10 | 13 | 560 | " |
| 108 | 40.08 | 0.65 | 9.10 | 3.91 | 61.0 | 6.11 | 27.02 | 152 | 127 | 3000 | 78 | 19 | 2 | 127 | 17 | 420 | 1,110 | 28 | 12 | 2 | 380 | Awissawella |
| 113 | 11.60 | 0.48 | 1.80 | 0.78 | 31.7 | 2.42 | 2.01 | 98 | 49 | 720 | 32 | 8 | 2 | 1 | 82 | 71 | 3,200 | 270 | 10 | 3 | 170 | Hatton |
| 128 | 40.08 | 5.31 | 13.70 | 0.42 | 61.0 | 4.43 | 40.01 | 172 | 122 | 720 | 72 | 10 | 42 | 1 | 27 | 22 | 820 | 12 | 11 | 27 | 220 | Passara |
| 129 | 40.08 | 3.13 | 22.90 | 0.36 | 104.9 | 4.74 | 27.02 | 153 | 113 | 110 | 70 | 20 | 4 | 1 | 21 | 13 | 110 | 70 | 2 | 37 | 10000 | " |
| 140 | 60.12 | 2.39 | 22.90 | 34.19 | 129.3 | 4.47 | 72.11 | 122 | 100 | 5000 | 42 | 13 | 3 | 117 | 10 | 92 | 10,000 | 122 | 9 | 2 | 270 | Gampaha |
| 142 | 40.02 | 4.83 | 2.30 | 1.56 | 61.1 | 4.43 | 22.01 | 117 | 120 | 1220 | 18 | 10 | 3 | 110 | 7 | 94 | 7,000 | 320 | 11 | 3 | 490 | " |
| 144 | 60.12 | 12.10 | 9.90 | 3.91 | 117.1 | 6.82 | 41.02 | 211 | 200 | 3110 | 13 | 12 | 1 | 17 | 3 | 95 | 3,200 | 110 | 78 | 3 | 210 | " |
| 146 | 42.28 | 3.48 | 11.71 | 3.91 | 61.0 | 5.81 | 28.11 | 204 | 120 | 1700 | 21 | 14 | 7 | 1 | 8 | 71 | 11,000 | 320 | 12 | 7 | 390 | " |
| 147 | 40.08 | 2.64 | 19.61 | 3.91 | 61.0 | 5.82 | 32.01 | 179 | 111 | 4000 | 71 | 13 | 8 | 1 | 10 | 70 | 17,000 | 73 | 10 | 1 | 420 | " |
| 184 | 60.12 | 11.90 | 22.91 | 5.87 | 122.0 | 4.31 | 72.00 | 170 | 200 | 70 | 70 | 3 | 7 | 2 | 73 | 77 | 1,000 | 17 | 922 | 98 | 1700 | Nilgala |
| 243 | 140.28 | 12.05 | 68.90 | 16.81 | 263.6 | 192.10 | 100.00 | 470 | 400 | 620 | 112 | 10 | 2 | 122 | 69 | 142 | 600 | 337 | 327 | 2 | 30 | Maha Oya |
| 275 | 100.00 | 36.46 | 0.21 | 0.39 | 196.5 | 101.30 | 100.00 | 500 | 400 | 410 | 76 | 18 | 37 | 2 | 43 | 120 | 2,600 | 27 | 718 | 12 | 230 | Piandala |
| 288 | 100.00 | 36.46 | 22.91 | 12.90 | 254.4 | 150.11 | 72.00 | 540 | 400 | 110 | 111 | 13 | 22 | 27 | 37 | 317 | 4,600 | 117 | 137 | 14 | 40 | Elahera |
| 473 | 66.73 | 36.47 | 2.29 | nd | 190.3 | 115.75 | 31.97 | 422 | 317 | 610 | 142 | 10 | 118 | 1 | 19 | 27 | 3,100 | 7 | 52 | 11 | 1100 | Kala Oya |
| 477 | 79.36 | 12.16 | 183.90 | 8.21 | 208.6 | 53.40 | 300.00 | 400 | 248 | 170 | 72 | 01 | 13 | 11 | 31 | 18 | 3,200 | 11 | 33 | 31 | 400 | " |
| 478 | 91.26 | 12.16 | 45.97 | 27.38 | 253.2 | 34.58 | 119.95 | 353 | 278 | 270 | 71 | 12 | 2 | 17 | 30 | 27 | 2,100 | 12 | 37 | 38 | 100 | " |

Chemical Results of the Sampled Well Water Mg - SO₄ Subgroup

| Loca- tion No. | Ca | Mg | Na | K | HCO ₃ | SO ₄ | Cl | TDS | Total Hard- ness | Total Fe | Total Cr | Total Co | Total V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | SiO ₂ | F | Topographic Sheet |
|----------------------|--------|--------|--------|--------|------------------|-----------------|-------|------|-----------------------------|-------------|-------------|-------------|------------|-----|-----|-----------------|-----------------|-----------------|------------------|-----|----------------------|
| | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm in CaCO ₃ | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppm | ppb | |
| 12 | 66.12 | 45.63 | 2.52 | 0.39 | 61.0 | 187.50 | 70.00 | 370 | 320 | 2210 | 18 | 22 | 33 | 41 | 2 | 320 | 27 | 48 | 11 | 420 | Morawaka |
| 459 | 200.40 | 308.77 | 91.95 | 41.06 | 915.0 | 1200.00 | 1.98 | 1770 | 1770 | 2000 | 12 | 1 | 30 | 25 | 50 | 2000 | 60 | 14 | 3 | 430 | Tibulketiya |
| 460 | 601.20 | 611.71 | 206.89 | 233.08 | 1220.2 | 3746.39 | 10.00 | 4170 | 4170 | 1600 | 14 | 3 | 35 | 24 | 75 | 3000 | 48 | 92 | 8 | 460 | " |
| 462 | 26.37 | 36.46 | 22.98 | 17.43 | 122.0 | 144.09 | 27.00 | 490 | 216 | 1450 | 83 | 4 | 48 | 22 | 88 | 110 | 45 | 11 | 13 | 490 | " |
| 463 | 39.87 | 72.93 | 22.98 | 12.63 | 183.0 | 192.12 | 81.99 | 450 | 400 | 1250 | 12 | 17 | 75 | 23 | 80 | 820 | 45 | 12 | 2 | 490 | " |
| 465 | 36.07 | 253.58 | 22.98 | 13.19 | 732.1 | 480.30 | 7.00 | 1005 | 1044 | 1450 | 19 | 2 | 75 | 23 | 77 | 1700 | 60 | 22 | 3 | 530 | " |
| 466 | 83.37 | 243.13 | 22.98 | 14.86 | 274.5 | 960.61 | 10.00 | 1695 | 1214 | 1600 | 17 | 1 | 80 | 24 | 50 | 700 | 65 | 2 | 1 | 505 | " |
| 467 | 75.15 | 121.56 | 45.97 | 69.61 | 305.0 | 516.33 | 10.06 | 1712 | 688 | 2050 | 8 | 3 | 48 | 20 | 48 | 600 | 65 | 16 | 10 | 510 | " |
| 468 | 89.37 | 243.13 | 22.98 | 29.78 | 305.0 | 982.70 | 27.00 | 1462 | 1224 | 2000 | 7 | 2 | 30 | 20 | 30 | 600 | 65 | 1 | 14 | 800 | " |

Chemical Results of the Sampled Well Water Mg - Cl Subgroup

| | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|-------|-------|-------|-------|--------|------|-----|------|----|----|----|----|-----|------|-----|-----|----|------|--------------|
| 148 | 6.75 | 24.31 | 22.98 | 2.02 | 121.4 | 4.41 | 17.00 | 200 | 117 | 2320 | 17 | 14 | 3 | 12 | 77 | 7000 | 70 | 12 | 7 | 420 | Gampaha |
| 180 | 7.95 | 24.31 | 16.17 | 7.82 | 128.1 | 19.11 | 32.00 | 110 | 120 | 720 | 44 | 16 | 3 | 1 | 410 | 2160 | 127 | 221 | 30 | 130 | Hanguranketa |
| 186 | 19.92 | 60.50 | 9.19 | 12.51 | 305.0 | 3.57 | 28.00 | 152 | 300 | 170 | 42 | 7 | 3 | 7 | 27 | 270 | 47 | 792 | 7 | 3780 | Nilgala |
| 411 | 100.20 | 8.74 | 0.22 | 39.10 | 434.4 | 3.45 | 170.00 | 1510 | 610 | 120 | 28 | 7 | 47 | 27 | 70 | 1270 | 82 | 17 | 17 | 1000 | Horowpatana |

Chemical Results of the Sampled Well Water Na + K/Cl Subgroup

| Loca- tion No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCO ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hard- ness CaCO ₃ ppm | Total Fe ppm | Min ppb | Total Cr ppb | Co ppb | Total V ppb | Cu ppb | En ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SrC ₂ ppm | F ppb | Topographic Sheet |
|----------------------|-----------|-----------|-----------|----------|-------------------------|------------------------|-----------|------------|---|--------------------|------------|--------------------|-----------|-------------------|-----------|-----------|------------------------|------------------------|------------------------|-------------------------|----------|----------------------|
| 3 | 64.02 | 21.32 | 160.90 | 4.34 | 153.8 | 20.20 | 320.00 | 372 | 250 | 3710 | 78 | 17 | 27 | 17 | 11 | 21 | 720 | 72 | 12 | 32 | 80 | Ambalangoda |
| 4 | 88.07 | 12.16 | 163.50 | 4.97 | 122.0 | 63.40 | 330.00 | 340 | 270 | 2800 | 93 | 10 | 10 | 12 | 12 | 12 | 2700 | 18 | 92 | 37 | 90 | " |
| 5 | 69.22 | 24.31 | 296.80 | 39.10 | 61.0 | 381.80 | 370.00 | 371 | 273 | 2100 | 122 | 20 | 11 | 27 | 13 | 17 | 1820 | 70 | 17 | 30 | 70 | " |
| 23 | 66.03 | 27.90 | 273.60 | 16.03 | 61.0 | 188.00 | 450.00 | 317 | 365 | 1710 | 140 | 3 | 1 | 10 | 2 | 18 | 310 | 110 | 20 | 40 | 1720 | Ambalantota |
| 28 | 216.00 | 60.12 | 919.00 | 15.64 | 555.8 | 53.31 | 1560.00 | 692 | 692 | 110 | 100 | 1 | 17 | 2 | 10 | 50 | 720 | 70 | 27 | 14 | 1700 | Hambantota |
| 29 | 126.00 | 120.00 | 1333.00 | 35.19 | 616.8 | 101.34 | 2150.00 | 617 | 617 | 210 | 112 | 7 | 12 | 2 | 11 | 72 | 710 | 72 | 21 | 31 | 1800 | " |
| 31 | 8.39 | 10.4 | 58.96 | 4.47 | 67.7 | 5.28 | 100.00 | 82 | 46 | 3100 | 72 | 7 | 7 | 11 | 32 | 7 | 40,000 | 9 | 100 | 17 | 20 | Alutgama |
| 32 | 20.04 | 8.79 | 22.93 | 29.72 | 44.5 | 19.69 | 73.00 | 89 | 72 | 3200 | 63 | 10 | 3 | 7 | 12 | 2 | 41,000 | 17 | 111 | 22 | 130 | " |
| 47 | 60.12 | 10.34 | 114.00 | 23.69 | 51.0 | 96.06 | 217.00 | 137 | 176 | 200 | 111 | 8 | 2 | 17 | 10 | 71 | 210 | 72 | 41 | 27 | 730 | Rakwana |
| 50 | 60.12 | 5.55 | 712.00 | 18.38 | 128.7 | 5.28 | 1153.00 | 170 | 164 | 400 | 52 | 17 | 3 | 14.5 | 21 | 173 | 320 | 92 | 11 | 43 | 600 | " |
| 51 | 60.12 | 11.94 | 2252.00 | 38.32 | 183.0 | 27.37 | 2514.00 | 192 | 180 | 1200 | 58 | 1 | 2 | 14.2 | 20 | 232 | 6,000 | 17 | 7 | 41 | 610 | " |
| 52 | 87.99 | 100.00 | 1241.00 | 32.45 | 250.7 | 101.34 | 2091.00 | 478 | 470 | 300 | 74 | 3 | 1 | 140 | 9 | 60 | 10 | 111 | 2 | 31 | 700 | " |
| 55 | 83.96 | 60.12 | 183.00 | 17.09 | 311.7 | 101.34 | 298.00 | 375 | 360 | 170 | 57 | 1 | 17 | 12.7 | 32 | 71 | 110 | 20 | 11 | 42 | 600 | " |
| 56 | 20.04 | 40.04 | 114.00 | 5.47 | 61.0 | 53.31 | 178.00 | 501 | 100 | 700 | 120 | 2 | 1 | 200 | 70 | 25 | 920 | 100 | 7 | 71 | 720 | Yala |
| 59 | 9.88 | 4.86 | 45.98 | 19.98 | 25.6 | 5.30 | 100.00 | 248 | 42 | 3200 | 78 | 21 | 1 | 11 | 10 | 70 | 12,000 | 170 | 12 | 13 | 120 | Panadura |
| 50 | 40.08 | 4.82 | 68.97 | 15.25 | 85.4 | 48.00 | 120.00 | 399 | 92 | 3210 | 120 | 30 | 3 | 2 | 11 | 70 | 13,000 | 780 | 13 | 13 | 100 | " |
| 61 | 8.00 | 3.65 | 68.97 | 28.94 | 37.8 | 34.50 | 110.00 | 242 | 35 | 4000 | 122 | 35 | 8 | 7 | 22 | 20 | 12,000 | 320 | 7 | 12 | 10 | " |
| 62 | 20.04 | 1.93 | 68.97 | 37.04 | 61.0 | 34.50 | 120.00 | 370 | 58 | 2700 | 123 | 27 | 2 | 7 | 9 | 32 | 10,000 | 419 | 7 | 24 | 90 | " |
| 63 | 11.20 | 4.86 | 22.99 | 38.33 | 51.8 | 5.30 | 70.00 | 252 | 48 | 3200 | 123 | 28 | 12 | 8 | 7 | 31 | 12,000 | 229 | 2 | 1 | 70 | " |
| 64 | 10.80 | 1.21 | 56.51 | 4.69 | 1.2 | 4.80 | 97.00 | 257 | 47 | 2700 | 128 | 21 | 12 | 8 | 2 | 32 | 12,000 | 140 | 2 | 2 | 170 | " |
| 65 | 4.78 | 2.43 | 56.51 | 16.87 | 1.8 | 9.60 | 100.00 | 292 | 32 | 3700 | 125 | 21 | 17 | 7 | 2 | 17 | 12,000 | 332 | 7 | 14 | 200 | " |
| 66 | 8.39 | 4.86 | 56.51 | 26.63 | 6.1 | 1.92 | 120.00 | 382 | 22 | 2700 | 124 | 22 | 3 | 7 | 3 | 94 | 12,110 | 370 | 11 | 3 | 110 | " |
| 67 | 19.83 | 2.06 | 2.82 | 2.34 | 54.9 | 1.92 | 10.00 | 471 | 41 | 7000 | 77 | 19 | 2 | 10 | 22 | 92 | 21,000 | 170 | 17 | 42 | 130 | " |
| 69 | 10.40 | 3.64 | 28.25 | 9.60 | 1.2 | 3.36 | 70.00 | 274 | 52 | 3780 | 91 | 20 | 7 | 11 | 13 | 93 | 10,000 | 920 | 12 | 13 | 70 | " |
| 70 | 10.62 | 4.37 | 28.25 | 22.05 | 4.2 | 0.96 | 82.00 | 41 | 41 | 3780 | 92 | 20 | 8 | 10 | 14 | 91 | 20,000 | 720 | 21 | 31 | 170 | " |
| 80 | 2.00 | 1.19 | 5.65 | 1.90 | 26.1 | 0.48 | 12.00 | 19 | 75 | 80 | 70 | 1 | 3 | 7 | 17 | 17 | 418 | 1000 | 2 | 31 | 270 | Haputale |
| 90 | 20.04 | 0.60 | 91.95 | 4.94 | 43.9 | 0.52 | 170.00 | 75 | 50 | 120 | 71 | 7 | 3 | 7 | 12 | 315 | 780 | 720 | 7 | 3 | 1000 | Buttrala |
| 91 | 12.00 | 0.48 | 92.71 | 39.10 | 22.5 | 0.09 | 200.00 | 75 | 50 | 120 | 71 | 7 | 3 | 7 | 12 | 315 | 780 | 720 | 7 | 3 | 1000 | " |
| 98 | 2.79 | 0.36 | 68.96 | 25.53 | 61.0 | 2.92 | 88.00 | 22 | 22 | 100 | 100 | 32 | 21 | 721 | 7 | 122 | 20,000 | 40 | 72 | 2 | 100 | Colombo |
| 101 | 20.04 | 1.66 | 45.97 | 3.16 | 56.7 | 4.80 | 71.00 | 190 | 94 | 3200 | 72 | 36 | 3 | 17 | 7 | 140 | 2,000 | 172 | 17 | 15 | 520 | Avissawella |
| 106 | 12.00 | 0.24 | 22.98 | 6.22 | 43.3 | 0.52 | 40.00 | 142 | 35 | 2370 | 77 | 27 | 8 | 7 | 15 | 210 | 1,000 | 43 | 11 | 7 | 410 | " |

Cont; Na + K/Cl Subgroup

| | | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|---------|--------|--------|--------|---------|------|------|------|-----|----|-----|-----|-----|-----|--------|-----|------|-----|------|-------------------|
| 130 | 20.04 | 1.44 | 68.96 | 38.57 | 61.0 | 3.45 | 120.00 | 143 | 56 | 330 | 70 | 13 | 47 | 2 | 22 | 27 | 720 | 131 | 11 | 48 | 2780 | Topographic Sheet |
| 132 | 51.22 | 12.15 | 137.00 | 4.70 | 155.5 | 4.41 | 200.00 | 240 | 178 | 130 | 70 | 8 | 13 | 22 | 100 | 13 | 110 | 120 | 42 | 12 | 200 | Passara |
| 136 | 27.98 | 12.15 | 91.95 | 36.68 | 83.6 | 5.85 | 170.00 | 270 | 120 | 440 | 72 | 10 | 112 | 18 | 21 | 42 | 170 | 71 | 80 | 42 | 210 | Puttuvi |
| 150 | 40.08 | 4.10 | 5.97 | 20.02 | 18.9 | 9.60 | 90.00 | 290 | 112 | 2120 | 27 | 20 | 1 | 8 | 7 | 13 | 3,100 | 41 | 11 | 2 | 270 | Gampaha |
| 152 | 64.44 | 12.15 | 91.95 | 25.27 | 183.0 | 5.81 | 165.00 | 170 | 211 | 1800 | 95 | 10 | 22 | 12 | 60 | 42 | 350 | 530 | 120 | 3 | 100 | Kandy |
| 174 | 40.08 | 2.89 | 68.96 | 2.85 | 73.8 | 47.05 | 110.00 | 122 | 89 | 2100 | 210 | 12 | 3 | 4 | 37 | 317 | 2,000 | 70 | 60 | 14 | 20 | Hanguranketa |
| 194 | 60.12 | 12.00 | 250.00 | 387.56 | 176.9 | 3.88 | 320.00 | | 200 | 1120 | 112 | 7 | 47 | 7 | 11 | 22 | 3,100 | 21 | 920 | 3 | 20 | Chilaw |
| 195 | 40.08 | 4.80 | 183.00 | 23.46 | 77.4 | 2.79 | 720.00 | | 120 | 2000 | 110 | 2 | 37 | 21 | 17 | 27 | 3,000 | 17 | 1010 | 12 | 110 | " |
| 196 | 60.12 | 4.80 | 91.00 | 32.06 | 183.0 | 1.63 | 170.00 | | 170 | 3210 | 112 | 7 | 37 | 31 | 22 | 17 | 3,000 | 12 | 1277 | 7 | 100 | " |
| 199 | 40.08 | 12.10 | 91.00 | 37.86 | 115.9 | 3.57 | 180.00 | | 150 | 6820 | 78 | 7 | 32 | 2 | 11 | 10 | 5,000 | 70 | 22 | 12 | 170 | Dandagamuwa |
| 210 | 20.04 | 9.65 | 114.00 | 3.13 | 61.0 | 3.09 | 180.00 | | 90 | 870 | 62 | 7 | 3 | 12 | 27 | 87 | 4,600 | 322 | 12 | 17 | 20 | Kurunegala |
| 213 | 40.08 | 2.88 | 116.00 | 19.95 | 122.0 | 0.78 | 200.00 | | 112 | 120 | 66 | 17 | 1 | 22 | 73 | 37 | 3,200 | 127 | 118 | 4 | 170 | " |
| 216 | 60.12 | 12.82 | 91.00 | 28.70 | 183.0 | 34.58 | 180.00 | | 108 | 190 | 70 | 8 | 2 | 27 | 82 | | 4,400 | 422 | 32 | 11 | 100 | " |
| 223 | 40.08 | 4.83 | 160.00 | 2.34 | 122.0 | 19.11 | 250.00 | | 120 | 710 | 70 | 5 | 17 | 32 | 51 | 27 | 14,200 | 320 | 21 | 12 | 110 | " |
| 224 | 20.04 | 6.54 | 45.00 | 10.55 | 61.0 | 25.88 | 80.00 | 127 | 77 | 120 | 50 | 16 | 21 | 37 | 52 | 26 | 5,800 | 218 | 27 | 21 | 200 | " |
| 225 | 20.04 | 6.54 | 114.00 | 17.98 | 67.7 | 25.93 | 190.00 | nd | 77 | 120 | 41 | 8 | 22 | 41 | 60 | 73 | 6,600 | 17 | 17 | 52 | 110 | " |
| 252 | 156.00 | 36.54 | 643.00 | 14.07 | 1043.9 | 34.58 | 719.00 | nd | 540 | 440 | 100 | 10 | 02 | 31 | 143 | 22 | 10,100 | 217 | 720 | 27 | 720 | Kalmunai |
| 256 | 12.81 | 12.15 | 137.00 | 72.39 | 268.0 | 5.30 | 310.00 | 700 | 370 | 210 | 80 | 2 | 3 | 48 | 170 | 73 | 10,100 | 157 | 270 | 22 | 230 | " |
| 258 | 40.08 | 5.81 | 137.00 | 32.65 | 26.3 | 101.34 | 240.00 | 640 | 124 | 720 | 112 | 18 | 21 | 7 | 62 | 10 | 6,000 | 17 | 420 | 110 | 500 | Attulu Oya |
| 259 | 40.08 | 6.54 | 137.00 | 19.08 | 122.0 | 25.81 | 230.00 | 700 | 127 | 610 | 120 | 5 | 21 | 2 | 61 | 20 | 2,700 | 9 | 572 | 127 | 700 | " |
| 260 | 40.08 | 12.12 | 91.00 | 31.20 | 122.0 | 47.64 | 170.00 | 470 | 150 | 110 | 111 | 3 | 21 | 2 | 73 | 17 | 3,100 | 7 | 720 | 21 | 1000 | " |
| 261 | 60.12 | 0.93 | 206.00 | 19.47 | 189.7 | 34.58 | 310.00 | 571 | 154 | 40 | 120 | 13 | 32 | 3 | 79 | 13 | 6,400 | 122 | 17 | 12 | 430 | Wariyapola |
| 262 | 20.04 | 2.17 | 252.00 | 11.37 | 67.7 | 44.18 | 370.00 | 1082 | 59 | 40 | 120 | 10 | 17 | 2 | 47 | 12 | 4,200 | 47 | 12 | 110 | 320 | " |
| 264 | 86.45 | 24.31 | 275.00 | 38.32 | 195.8 | 67.72 | 520.00 | 540 | 316 | 710 | 140 | 12 | 3 | 2 | 42 | 17 | 800 | 270 | 17 | 12 | 430 | " |
| 307 | 88.00 | 48.62 | 321.00 | 18.77 | 427.0 | 58.17 | 414.00 | 300 | 420 | 560 | 110 | 2 | 11 | 22 | 121 | 141 | 20,000 | 3 | 90 | 27 | 3200 | Rukam |
| 308 | 100.00 | 34.46 | 229.00 | 6.67 | 304.4 | 53.46 | 420.00 | 420 | 400 | 110 | 117 | 2 | 13 | 227 | 172 | 141 | 110 | 72 | 12 | 17 | 3100 | " |
| 309 | 176.00 | 12.15 | 252.00 | 31.67 | 536.3 | 58.17 | 410.00 | 400 | 490 | 720 | 122 | 7 | 17 | 113 | 170 | 132 | 10,700 | 20 | 18 | 21 | 3120 | " |
| 310 | 156.00 | 12.15 | 229.00 | 19.16 | 427.0 | 34.58 | 410.00 | 440 | 440 | 470 | 20 | 1 | 22 | 117 | 170 | 131 | 21,000 | 17 | 27 | 22 | 980 | " |
| 313 | 120.00 | 4.78 | 758.00 | 0.78 | 311.7 | 48.99 | 120.00 | 470 | 320 | 110 | 120 | 3 | 27 | 117 | 180 | 32 | 22,000 | 120 | 1142 | 47 | 670 | Batticaloa |
| 314 | 100.00 | 12.15 | 482.00 | 13.68 | 300.1 | 101.34 | 720.00 | 500 | 300 | 120 | 200 | 2 | 117 | 217 | 146 | 142 | 21,000 | 77 | 1224 | 22 | 700 | " |
| 316 | 287.00 | 48.62 | 919.00 | 20.72 | 630.8 | 106.14 | 1642.00 | 3137 | 918 | 360 | 160 | 10 | 2 | 3 | 47 | 71 | 2,000 | 90 | 1400 | 14 | 450 | Futtalam |
| 317 | 410.00 | 91.05 | 1149.00 | 18.38 | 1226.9 | 53.40 | 2004.00 | 3812 | 1376 | 320 | 240 | 11 | 3 | 2 | 43 | 82 | 2,000 | 20 | 1700 | 13 | 700 | " |
| 322 | 80.00 | 6.56 | 183.00 | 11.34 | 244.0 | 44.66 | 280.00 | 708 | 227 | 360 | 220 | 17 | 1 | 3 | 27 | 17 | 4,800 | 97 | 32 | 8 | 300 | Dambulla |
| 323 | 80.00 | 5.10 | 298.00 | 5.47 | 250.7 | 44.18 | 444.00 | 720 | 221 | 1100 | 170 | 2 | 7 | 2 | 24 | 73 | 7,800 | 92 | 14 | 2 | 130 | " |
| 324 | 100.00 | 5.95 | 252.00 | 37.57 | 305.0 | 15.36 | 430.00 | 700 | 975 | 760 | 74 | 3 | 3 | 27 | 27 | 72 | 11,000 | 27 | 17 | 3 | 400 | " |
| 326 | 100.00 | 4.74 | 137.00 | 15.55 | 196.4 | 44.18 | 310.00 | 300 | 320 | 720 | 20 | 22 | 117 | 28 | 72 | 310 | 110 | 27 | 22 | 7 | 8210 | Polonnaruwa |

Cont;

Na + K/Cl Subgroup

| Topographic Sheet | Polonnaruwa | Vakanneri | Kalpitiya | Anuradhapura | Kaudulla | Kathiraveli | Marichchukkaddi | Madawachchiya | Horowpotana | Trincomalee | | | | | | |
|-------------------|-------------|-----------|-----------|--------------|----------|-------------|-----------------|---------------|-------------|-------------|-----|-----|-----|--------|----|------|
| 327 | 120.00 | 10.08 | 206.00 | 22.68 | 257.4 | 24.97 | 410.00 | 340 | 17 | 17 | 39 | 132 | 422 | 210 | 17 | 28 |
| 335 | 20.16 | 7.78 | 252.00 | 23.46 | 189.7 | 48.03 | 430.00 | 342 | 7 | 13 | 312 | 142 | 172 | 210 | 71 | 332 |
| 338 | 208.00 | 48.62 | 367.00 | 23.81 | 629.6 | 20.17 | 720.00 | 1500 | 9 | 7 | 1 | 19 | 27 | 1,000 | 27 | 470 |
| 339 | 220.00 | 36.46 | 758.00 | 26.59 | 666.2 | 44.18 | 1270.00 | 1400 | 12 | 3 | 1 | 18 | 32 | 2,100 | 17 | 137 |
| 354 | 80.00 | 7.78 | 137.00 | 19.16 | 250.7 | 44.66 | 216.00 | 653 | 2 | 42 | 417 | 19 | 10 | 22,000 | 32 | 47 |
| 365 | 120.00 | 5.03 | 275.00 | | 866.0 | 5.28 | 436.00 | 1052 | 5 | 127 | 22 | 22 | 170 | 7,000 | 54 | 317 |
| 370 | 82.00 | 48.62 | 206.00 | 29.87 | 427.0 | 34.58 | 360.00 | 542 | 18 | 22 | 22 | 32 | 42 | 610 | 37 | 415 |
| 371 | 67.00 | 36.46 | 252.00 | 1.95 | 311.7 | 34.58 | 410.00 | | 7 | 18 | 13 | 69 | 127 | 1,000 | 17 | 277 |
| 376 | 120.00 | 5.27 | 206.00 | 32.45 | 311.7 | 34.58 | 369.90 | 348 | 15 | 17 | 1 | 78 | 317 | 190 | 52 | 112 |
| 377 | 80.00 | 24.31 | 183.90 | 10.95 | 304.6 | 39.38 | 300.00 | 348 | 16 | 18 | 1 | 78 | 218 | 2,000 | 54 | 22 |
| 378 | 68.00 | 36.46 | 183.90 | 21.95 | 268.0 | 5.28 | 369.90 | 392 | 18 | 1 | 2 | 111 | 340 | 1,100 | 50 | 47 |
| 381 | 83.00 | 14.04 | 459.00 | 11.73 | 263.5 | 39.38 | 719.60 | 400 | 3 | 2 | 3 | 120 | 172 | 2,700 | 17 | 92 |
| 383 | 96.00 | 48.62 | 206.00 | 39.03 | 372.7 | 39.38 | 419.90 | 987 | 3 | 13 | 17 | 170 | 172 | 2,700 | 37 | 74 |
| 385 | 100.00 | 12.15 | 735.00 | 35.19 | 226.9 | 63.40 | 1201.10 | 712 | 1 | 41 | 1 | 200 | 440 | 11,200 | 12 | 60 |
| 388 | 80.00 | 5.30 | 666.00 | 3.51 | 244.0 | 63.40 | 1000.00 | 700 | 2 | 10 | 1 | 170 | 210 | 10,200 | 7 | 50 |
| 387 | 88.00 | 24.31 | 597.00 | 23.85 | 250.7 | 34.58 | 1000.00 | 600 | 7 | 20 | 2 | 320 | 210 | 700 | 10 | 70 |
| 388 | 80.00 | 51.44 | 758.00 | 21.50 | 433.8 | 39.38 | 1201.20 | 622 | 3 | 10 | 10 | 420 | 440 | 7,000 | 20 | 50 |
| 389 | 66.00 | 36.46 | 712.00 | 28.94 | 230.7 | 5.28 | 1200.00 | 700 | 7 | 20 | 10 | 400 | 320 | 200 | 30 | 70 |
| 390 | 62.00 | 36.46 | 827.00 | 30.50 | 244.6 | 10.08 | 1370.00 | | 7 | 20 | 2 | 22 | 140 | 270 | 22 | 1937 |
| 391 | 40.00 | 3.62 | 459.00 | 1.56 | 56.1 | 53.31 | 719.90 | 115 | 1 | 3 | 21 | 22 | 20 | 270 | 23 | 1127 |
| 392 | 90.00 | 36.42 | 1103.00 | 17.20 | 263.5 | 149.37 | 1720.00 | 376 | 2 | 22 | 17 | 31 | 10 | 110 | 21 | 1320 |
| 393 | 60.00 | 9.43 | 1195.00 | 30.50 | 108.3 | 34.58 | 1919.90 | 189 | 2 | 21 | 17 | 44 | 14 | 210 | 17 | 1311 |
| 394 | 84.00 | 12.15 | 1172.00 | 7.82 | 250.7 | 34.58 | | 260 | 3 | 17 | 11 | 43 | 12 | | 12 | 1402 |
| 395 | 82.00 | 27.96 | 1264.00 | 28.54 | 330.0 | 15.36 | 2000.00 | 321 | 2 | 22 | 2 | 18 | 70 | 10 | 17 | 1321 |
| 396 | 80.00 | 2.38 | 91.00 | 30.34 | 195.8 | 5.82 | 200.00 | 210 | 3 | 28 | 7 | 32 | 22 | 810 | 22 | 377 |
| 400 | 200.00 | 53.36 | 1011.00 | 32.06 | 677.8 | 34.58 | 1700.00 | 820 | 5 | 18 | 13 | 27 | 7 | 700 | 27 | 112 |
| 401 | 140.00 | 6.06 | 666.00 | 10.55 | 305.0 | 7.80 | 1270.00 | 717 | 2 | 117 | 17 | 22 | 2 | 2,100 | 32 | 227 |
| 402 | 100.00 | 7.02 | 1000.00 | 39.10 | 262.9 | 14.40 | 1700.00 | 617 | 2 | 32 | 27 | 24 | 7 | 2,100 | 13 | 73 |
| 405 | 200.00 | 3.63 | 482.00 | 106.37 | 427.0 | 5.33 | 1000.00 | 717 | 2 | 2 | 27 | 22 | 120 | 1,700 | 32 | 100 |
| 408 | 110.00 | 6.07 | 337.00 | 38.71 | 348.9 | 2.01 | 720.00 | 700 | 2 | 273 | 37 | 72 | 41 | 110 | 37 | 17 |
| 412 | 16.00 | 1.21 | 741.00 | 28.15 | 353.2 | 0.52 | 1200.00 | 7000 | 11 | 27 | 22 | 220 | 77 | 2,000 | 82 | 113 |
| 416 | 168.60 | 2.43 | 321.00 | 35.97 | 305.0 | 4.37 | 720.00 | 620 | 13 | 173 | 712 | 122 | 120 | 11,000 | 60 | 92 |
| 417 | 148.00 | 6.07 | 643.00 | 39.10 | 427.0 | 4.80 | 1200.00 | 618 | 12 | 117 | 112 | 100 | 700 | 9,200 | 92 | 148 |
| 418 | 116.00 | 3.64 | 1360.00 | 43.80 | 353.8 | 5.81 | 2200.00 | 512 | 11 | 217 | 117 | 100 | 420 | 7,200 | 97 | 90 |
| 419 | 102.00 | 4.48 | 1333.00 | 43.41 | 311.7 | 4.41 | 2200.00 | 517 | 14 | 217 | 117 | 200 | 600 | 1,700 | 97 | 90 |

Cont; Na + K/Cl Subgroup

| | 420 | 425 | 426 | 427 | 429 | 430 | 431 | 432 | 436 | 437 | 438 | 443 | 445 | 446 | 448 | 449 | 450 | 469 | 470 | 472 | 475 | 479 | 481 | 482 | |
|-------------------|-------------|----------|---------|--------|---------|----------|---------|----------|---------|---------|-----------|---------|--------|--------|--------|--------|--------|----------|--------|--------|--------|---------|--------|--------|--------|
| | 140.00 | 220 | 226.00 | 222.00 | 208.00 | 148.00 | 200.00 | 300.00 | 216.03 | 204.00 | 220.00 | 160.00 | 87.00 | 94.42 | 40.08 | 40.08 | 12.82 | 67.94 | 110.00 | 51.30 | 72.00 | 92.06 | 75.23 | 96.87 | |
| | 1.21 | 8.50 | 3.71 | 6.07 | 8.50 | 8.50 | 97.01 | 60.53 | 97.25 | 109.00 | 85.00 | 3.79 | 24.31 | 36.46 | 11.67 | 3.89 | 36.46 | 12.16 | 12.16 | 19.94 | 12.16 | 24.31 | 12.16 | | |
| | 1195.00 | 580.00 | 955.00 | 32.00 | 966.00 | 992.00 | 511.00 | 1678.00 | 1057.00 | 678.16 | 781.60 | 643.67 | 206.89 | 114.94 | 160.91 | 206.89 | 183.90 | 321.83 | 321.83 | 344.82 | 206.89 | 275.86 | 505.74 | 344.82 | 160.92 |
| | 49.92 | 145.48 | 35.97 | 39.10 | 82.51 | 43.41 | 67.26 | 23.85 | 34.41 | 19.55 | 1.95 | 8.21 | 10.16 | 28.15 | 23.85 | 35.19 | 28.00 | 150.00 | 179.00 | 195.00 | 82.00 | 243.00 | 150.00 | 117.00 | |
| | 305.0 | 616.8 | 483.2 | 471.6 | 610.1 | 556.4 | 427.6 | 1043.9 | 1037.2 | 738.0 | 921.0 | 488.0 | 372.0 | 439.0 | 128.0 | 183.0 | 243.0 | 427.0 | 422.0 | 427.0 | 220.0 | 274.0 | 195.0 | 258.0 | |
| | 3.45 | 14.40 | 4.80 | 4.80 | 14.45 | 4.89 | 53.31 | 14.88 | 34.58 | 35.00 | 44.00 | 15.00 | 20.00 | 24.00 | 15.36 | 44.18 | 5.28 | 206.00 | 48.00 | 154.00 | 53.00 | 53.00 | 53.00 | 34.00 | |
| | 2000.00 | 1200.00 | 1700.00 | 420.00 | 1720.00 | 1720.00 | 1200.00 | 2700.00 | 1700.00 | 1270.00 | 1270.00 | 1000.00 | 320.00 | 203.00 | 290.00 | 294.90 | 1012 | 620.00 | 700.00 | 470.00 | 490.00 | 1000.00 | 20.00 | 410.00 | |
| | 617 | 2100 | 2100 | 1210 | 1700 | 1700 | 1300 | 1500 | 1500 | 1700 | 2000 | 953 | 1300 | 1919 | 1480 | 452 | 420 | 444 | 443 | 342 | 453 | | | | |
| | 400 | 900 | 720 | 800 | 870 | 720 | 900 | 1000 | 940 | 960 | 900 | 416 | 320 | 386 | 398 | 202 | 423 | 327 | 372 | 178 | 332 | 280 | 288 | 292 | |
| | 820 | 480 | 400 | 400 | 320 | 460 | 640 | 820 | 3800 | 3800 | 400 | 220 | 400 | 720 | 560 | 2000 | 420 | 320 | 320 | 610 | 810 | 110 | 1000 | 1110 | |
| | 340 | 31 | 48 | 27 | 22 | 22 | 21 | 20 | 24 | 72 | 23 | 190 | 190 | 270 | 430 | 430 | 120 | 170 | 120 | 142 | 75 | 72 | 78 | 75 | |
| | 12 | 2 | 7 | 3 | 2 | 13 | 14 | 17 | 12 | 2 | 3 | 10 | 14 | 19 | 21 | 17 | 7 | 3 | 2 | 9 | 7 | 2 | 12 | 11 | |
| | 200 | 1 | 78 | 27 | 17 | 42 | 17 | 22 | 27 | 1 | 11 | 12 | 12 | 2 | 8 | 11 | 2 | 1 | 211 | 273 | 24 | 12 | 11 | 2 | |
| | 100 | 1 | 11 | 1 | 2 | 1 | 3 | 2 | 12 | 1 | 1 | 12 | 11 | 2 | 17 | 2 | 27 | 2 | 2 | 18 | 32 | 42 | 36 | 41 | |
| | 200 | 22 | 17 | 22 | 24 | 300 | 1700 | 420 | 21 | 20 | 27 | 24 | 21 | 61 | 71 | 17 | 17 | 22 | 18 | 70 | 10 | 22 | 72 | 17 | |
| | 520 | 70 | 43 | 22 | 24 | 300 | 1700 | 21 | 21 | 20 | 27 | 24 | 21 | 63 | 71 | 17 | 17 | 22 | 18 | 70 | 10 | 22 | 72 | 17 | |
| | 200 | 70 | 43 | 22 | 24 | 300 | 1700 | 21 | 21 | 20 | 27 | 24 | 21 | 63 | 71 | 17 | 17 | 22 | 18 | 70 | 10 | 22 | 72 | 17 | |
| | 90 | 427 | 11 | 30 | 22 | 28 | 27 | 11 | 12 | 17 | 22 | 37 | 47 | 92 | 42 | 97 | 8 | 11 | 17 | 37 | 9 | 17 | 10 | 12 | |
| | 3100 | 1000 | 750 | 200 | 1000 | 1800 | 1000 | 800 | 1500 | 1400 | 130 | 1000 | 1000 | 500 | 1000 | 700 | 600 | 1500 | 1200 | 1100 | 1000 | 1100 | 330 | 310 | |
| Topographic Sheet | Trincomalee | Vavuniya | " | Mantai | " | Nilaveli | " | Padawiya | " | " | Galgamuwa | " | " | " | " | " | " | Kala Oya | " | " | " | " | " | " | |

Chemical Results of the Sampled Well Water Na + K/SO₄ Subgroup

| Loca- tion No. | Ca | Mg | Na | K | HCO ₃ | SO ₄ | Cl | TDS | Total Hard- ness CaCO ₃ | Total Fe | Total Mn | Total Cr | Co | Total V | Cu | Zn | NO ₃ | NO ₂ | NH ₄ | SiO ₂ | F | |
|----------------------|------|------|-------|-------|------------------|-----------------|-----|-----|--|----------|----------|----------|-----|---------|-----|-----|-----------------|-----------------|-----------------|------------------|-----|--------------------------|
| | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm in CaCO ₃ | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppm | ppb | ppb Topographic Sheet |
| 25 | 0.21 | 0.01 | 25.5 | 0.04 | 6.7 | 35.1 | 10 | 432 | 401 | 2000 | 77 | 7 | 4 | 12 | 3 | 21 | 810 | 71 | 47 | 28 | 500 | Ambalantota |
| 40 | 6.80 | 4.00 | 2.29 | 18.48 | 43.9 | 5.28 | 10 | 42 | 27 | 720 | 43 | 20 | 27 | 7 | 30 | 7 | 1,300 | 80 | 12 | 3 | 100 | Rakwana |
| 68 | 20.4 | 0.22 | 68.96 | 17.83 | 60.4 | 4.80 | 120 | 384 | 53 | 250 | 82 | 21 | 1 | 10 | 12 | 34 | 9,700 | 182 | 10 | 11 | 170 | Panadura |

Chemical Results of the Samples Well Water Na + K/HCO₃ Subgroup

Chemical Results of the Sampled Well Water Na + K/NDA Subgroup

| | | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|--------|-------|-------|--------|--------|-----|-----|------|-----|----|-----|-----|-----|-----|--------|-----|------|-----|------|-------------|
| 44 | 80.00 | 11.02 | 91.95 | 38.32 | 183.0 | 96.06 | 161.00 | 340 | 328 | 1100 | 57 | 2 | 12 | 72 | 24 | 143 | 7,100 | 17 | 40 | 27 | 720 | Katharagama |
| 49 | 40.00 | 11.16 | 68.96 | 20.98 | 80.5 | 82.61 | 108.00 | 132 | 128 | 110 | 78 | 10 | 1 | 142 | 132 | 27 | 2,000 | 90 | 10 | 25 | 610 | " |
| 99 | 7.20 | 0.24 | 13.44 | 7.82 | 40.8 | 0.52 | 20.00 | 72 | 280 | 6220 | 112 | 30 | 17 | 222 | 2 | 712 | 11,000 | 45 | 70 | 1 | 500 | Colombo |
| 105 | 8.80 | 0.48 | 45.97 | 1.51 | 56.1 | 0.52 | 42.00 | 112 | 61 | 4490 | 70 | 22 | 7 | 2 | 12 | 270 | 1,000 | 17 | 12 | 10 | 330 | Avissawella |
| 115 | 20.04 | 0.22 | 22.98 | 4.81 | 57.3 | 4.41 | 10.00 | 112 | 51 | 910 | 30 | 2 | 1 | 1 | 80 | 80 | 10,000 | 137 | 11 | 7 | 30 | Hatton |
| 156 | 0.20 | 0.48 | 4.36 | 0.18 | 6.1 | 3.36 | 3.00 | 200 | 210 | 3100 | 90 | 7 | 111 | 17 | 67 | 18 | 3,520 | 210 | 1000 | 12 | 100 | Kandy |
| 253 | 156.00 | 12.15 | 206.89 | 29.33 | 475.2 | 82.61 | 320.00 | 420 | 440 | 440 | 100 | 7 | 1 | 30 | 141 | 21 | 10,300 | 317 | 770 | 122 | 400 | Kalmune |
| 281 | 100.00 | 2.36 | 114.94 | 24.24 | 305.0 | 63.46 | 158.00 | 340 | 360 | 110 | 82 | 21 | 7 | 1 | 47 | 210 | 6,000 | 17 | 617 | 27 | 70 | Nalanda |
| 304 | 87.00 | 48.62 | 183.90 | 17.20 | 433.8 | 101.44 | 270.00 | 420 | 420 | 210 | 120 | 3 | 22 | 17 | 111 | 42 | 100 | 17 | 87 | 2 | 1370 | Rukam |

Chemical Results of the Sampled Well Water NDC - Cl Subgroup

| Loca- tion No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCO ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hard- ness ppm in CaCO ₃ | Total Fe ppb | Mn ppb | Total Cr ppb | Co ppb | Total V ppb | Cu ppb | Zn ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SiO ₂ ppm | F ppb | Topographic Sheet | |
|----------------------|-----------|-----------|-----------|----------|-------------------------|------------------------|-----------|------------|--|--------------------|-----------|--------------------|-----------|-------------------|-----------|-----------|------------------------|------------------------|------------------------|-------------------------|----------|----------------------|---|
| 2 | 42.00 | 10.97 | 39.60 | 39.90 | 61.9 | 1.30 | 170.00 | 320 | 4200 | 2790 | 100 | 22 | 22 | 72 | 11 | 13 | 9,200 | 18 | 90 | 37 | 100 | Ambalangoda | |
| 19 | 60.10 | 6.52 | 48.50 | 42.60 | 128.8 | 54.30 | 130.00 | 1000 | 1770 | 73 | 73 | 12 | 12 | 20 | 2 | 22 | 110 | 62 | 89 | 3 | 780 | Ambalantota | |
| 21 | 86.00 | 36.40 | 48.50 | 0.39 | 61.7 | 37.50 | 280.00 | 470 | 500 | 2700 | 140 | 2 | 17 | 40 | 7 | 27 | 20 | 69 | 75 | 17 | 2000 | " | |
| 22 | 46.40 | 36.47 | 71.50 | 47.32 | 105.0 | 62.70 | 256.00 | 320 | 216 | 1180 | 122 | 4 | 22 | 11 | 7 | 12 | 10 | 120 | 27 | 43 | 1230 | " | |
| 54 | 50.60 | 60.12 | 91.90 | 30.05 | 199.0 | 3.40 | 266.00 | 320 | 304 | 210 | 75 | 7 | 1 | 157 | 20 | 73 | 100 | 11 | 11 | 32 | 600 | Kataramana | |
| 57 | 60.10 | 12.03 | 68.90 | 20.10 | 122.0 | 5.76 | 190.00 | 502 | 75 | 500 | 124 | 3 | 12 | 217 | 72 | 35 | 1,000 | 120 | 7 | 27 | 520 | Yala | |
| 77 | 2.60 | 1.33 | 2.82 | 2.73 | 0.6 | 0.95 | 10.00 | 43 | 12 | 920 | 92 | 10 | 1 | 2 | 17 | 217 | 2,000 | 27 | 20 | 3 | 200 | Haputale | |
| 87 | 4.30 | 2.43 | 7.58 | 0.18 | 7.0 | 3.36 | 20.00 | 92 | 20 | 700 | 48 | 17 | 1 | 17 | 6 | 372 | 120 | 111 | 11 | 15 | 700 | " | |
| 93 | 28.00 | 1.21 | 7.38 | 3.91 | 10.3 | 0.52 | 90.00 | 340 | 120 | 700 | 60 | 12 | 11 | 7 | 10 | 412 | 6,000 | 400 | 10 | 17 | 2370 | Burtala | |
| 97 | 40.00 | 0.24 | 45.97 | 1.85 | 59.7 | 3.45 | 92.00 | 1200 | 110 | 120 | 72 | 12 | 3 | 7 | 21 | 318 | 6,000 | 127 | 7 | 12 | 980 | " | |
| 103 | 3.80 | 0.48 | 7.22 | 11.73 | 43.3 | 0.04 | 26.00 | 114 | 42 | 2210 | 70 | 30 | 2 | 17 | 1 | 230 | 4,000 | 12 | 82 | 2 | 230 | Awissawella | |
| 135 | 10.00 | 36.46 | 121.00 | 39.10 | 348.9 | 4.41 | 270.00 | 1900 | 400 | 310 | 85 | 12 | 110 | 21 | 117 | 13 | 100 | 120 | 74 | 41 | 230 | Poruvil | |
| 139 | 60.10 | 4.83 | 45.00 | 85.32 | 122.0 | 4.80 | 117.00 | 200 | 170 | 6220 | 100 | 11 | 17 | 2 | 9 | 17 | 10,000 | 27 | 11 | 12 | 110 | Negombo | |
| 149 | 40.00 | 4.83 | 45.00 | 0.18 | 56.1 | 6.34 | 92.00 | 211 | 120 | 3000 | 12 | 24 | 2 | 2 | 7 | 27 | 2,000 | 72 | 13 | 3 | 500 | Gampaha | |
| 219 | 20.00 | 10.64 | 2.29 | 19.59 | 60.4 | 3.39 | 50.00 | 94 | 73 | 720 | 72 | 10 | 3 | 11 | 52 | 27 | 4,000 | 127 | 33 | 11 | 200 | Kurunegala | |
| 227 | 20.00 | 5.57 | 2.29 | 18.38 | 7.3 | 5.76 | 40.00 | 170 | 73 | 710 | 43 | 7 | 1 | 31 | 60 | 73 | 10,000 | 22 | 14 | 2 | 110 | " | |
| 255 | 147.00 | 36.46 | 229.00 | 26.20 | 450.2 | 101.34 | 410.00 | 420 | 520 | 110 | 120 | 7 | 8 | 31 | 120 | 17 | 10,000 | 132 | 300 | 17 | 310 | Kalmune | |
| 278 | 80.00 | 16.95 | 68.00 | 36.60 | 195.8 | 63.40 | 170.00 | 270 | 270 | 110 | 75 | 12 | 7 | 8 | 40 | 170 | 6,000 | 24 | 612 | 17 | 170 | Nalanda | |
| 305 | 95.00 | 12.15 | 114.00 | 2.73 | 263.5 | 53.36 | 200.00 | 440 | 300 | 170 | 112 | 7 | 17 | 111 | 122 | 121 | 820 | 2 | 27 | 13 | 2000 | Rukam | |
| 318 | 98.30 | 12.15 | 114.00 | 18.38 | 263.5 | 53.31 | 211.00 | 294 | 296 | 560 | 220 | 12 | 3 | 17 | 31 | 24 | 1,700 | 21 | 327 | 2 | 400 | Puttalam | |
| 319 | 100.00 | 4.80 | 91.00 | 38.71 | 196.4 | 19.21 | 340.00 | 616 | 270 | 480 | 430 | 7 | 17 | 2 | 23 | 10 | 7,200 | 70 | 47 | 11 | 720 | Dambulla | |
| 321 | 87.00 | 24.31 | 137.00 | 22.68 | 250.7 | 44.18 | 280.00 | 800 | 318 | 320 | 270 | 8 | 27 | 17 | 37 | 27 | 6,200 | 62 | 37 | 4 | 320 | " | |
| 328 | 120.00 | 10.61 | 137.00 | 33.63 | 366.0 | 5.28 | 270.00 | 700 | 344 | 110 | 38 | 12 | 30 | 42 | 72 | 500 | 100 | 42 | 12 | 7 | 13 130 | Polonnaruwa | |
| 379 | 80.00 | 55.31 | 206.00 | 19.94 | 313.1 | 10.08 | 270.00 | 388 | 428 | 210 | 20 | 12 | 3 | 3 | 64 | 415 | 110 | 27 | 22 | 10 | 3000 | Kaudulla | |
| 380 | 84.00 | 53.00 | 137.00 | 0.89 | 330.0 | 34.58 | 300.00 | 470 | 429 | 110 | 21 | 10 | 2 | 7 | 120 | 317 | 110 | 12 | 98 | 11 | 3200 | " | |
| 409 | 107.60 | 6.10 | 165.00 | 27.76 | 355.0 | 5.81 | 400.00 | 1700 | 520 | 270 | 22 | 2 | 113 | 13 | 75 | 40 | 420 | 97 | 27 | 31 | 1000 | Horowpatana | |
| 410 | 120.00 | 8.74 | 0.22 | 39.10 | 434.4 | 3.45 | 170.00 | 1500 | 600 | 170 | 2 | 3 | 42 | 71 | 120 | 22 | 600 | 92 | 32 | 37 | 970 | " | |
| 413 | 204.00 | 2.43 | 183.00 | 67.26 | 433.8 | 5.31 | 500.00 | 2150 | 610 | 410 | 22 | 22 | 32 | 37 | 198 | 22 | 2,700 | 86 | 113 | 17 | 1000 | " | |
| 414 | 220.00 | 12.15 | 114.00 | 105.00 | 682.7 | 5.81 | 400.00 | 2100 | 1200 | 581 | 230 | 24 | 17 | 42 | 37 | 240 | 27 | 7,000 | 82 | 17 | 32 | 1200 | " |
| 415 | 188.00 | 6.07 | 91.00 | 28.15 | 470.4 | 3.45 | 400.00 | 2150 | 720 | 130 | 27 | 10 | 32 | 43 | 220 | 13 | 9,000 | 82 | 32 | 37 | 1000 | " | |
| 422 | 260.00 | 8.50 | 224.00 | 38.71 | 610.1 | 4.75 | 700.00 | 2010 | 1000 | 400 | 22 | 1 | 8 | 3 | 17 | 27 | 2,000 | 17 | 322 | 47 | 800 | Vavuniya | |
| 433 | 312.00 | 48.62 | 275.00 | 14.47 | 629.6 | 63.40 | 720.00 | 2000 | 980 | 800 | 45 | 1 | 7 | 17 | 15 | 41 | 800 | 17 | 170 | 47 | 500 | Puliyankulam | |
| 484 | 71.00 | 24.31 | 68.00 | 27.76 | 189.7 | 67.72 | 179.00 | 295 | 295 | 1120 | 75 | 7 | 1 | 1 | 27 | 27 | 2,000 | 17 | 117 | 27 | 310 | Kala Oya | |

Chemical Results of the Sampled Well Water NDC - SO₄ Subgroup

| Location No. | Ca | Mg | Na | K | HCO ₃ | SO ₄ | Cl | TDS | Total Hardness CaCO ₃ | Total Fe | Mn | Total Cr | Co | Total V | Cu | Zn | NO ₃ | H ₂ O ₂ | NH ₄ | SiO ₂ | F | Other Remarks |
|--------------|-------|-------|-------|--------|------------------|-----------------|--------|-----|----------------------------------|----------|-----|----------|-----|---------|-----|-----|-----------------|-------------------------------|-----------------|------------------|------|---------------|
| | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm in CaCO ₃ | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppm | ppb | |
| 6 | 80.16 | 18.00 | 68.90 | 39.10 | 105.0 | 289.40 | 120.00 | 372 | 278 | 3100 | 110 | 22 | 12 | 23 | 11 | 21 | 100 | 120 | 81 | 17 | 100 | Ambalangoda |
| 17 | 80.16 | 53.87 | 48.50 | 4.30 | 128.8 | 297.40 | 97.00 | 453 | 422 | 2700 | 68 | 10 | 3 | 36 | 13 | 23 | 5000 | 10 | 82 | 68 | 210 | Morawaka |
| 18 | 86.81 | 48.63 | 30.40 | 8.21 | 128.8 | 339.00 | 25.00 | 437 | 417 | 3700 | 41 | 24 | 2 | 10 | 11 | 24 | 5210 | 21 | 80 | 63 | 10 | Morawaka |
| 24 | 84.81 | 48.63 | 25.50 | 0.39 | 122.0 | 272.20 | 60.00 | 428 | 412 | 2000 | 72 | 10 | 3 | 10 | 7 | 27 | 210 | 70 | 17 | 2 | 1920 | Ambalantota |
| 42 | 6.01 | 1.98 | 2.29 | 5.02 | 6.7 | 15.36 | 7.00 | 43 | 20 | 1960 | 42 | 19 | 11 | 7 | 10 | 2 | 2300 | 120 | 1 | 2 | 400 | Rakwana |
| 118 | 20.04 | 6.44 | 17.93 | 3.91 | 26.2 | 92.69 | | 114 | 77 | 1010 | 30 | 3 | 22 | 1 | 59 | 80 | 1700 | 420 | 21 | 12 | 70 | Hatton |
| 464 | 55.91 | 97.25 | 26.66 | 156.43 | 305.0 | 470.22 | 40.76 | 200 | 540 | | | 12 | 3 | | | | 900 | | 17 | 1 | nd | Timbolketiya |
| 474 | 86.57 | 24.31 | 91.95 | 36.74 | 245.2 | 293.51 | 37.00 | 448 | 312 | 720 | 122 | 17 | 22 | 22 | 21 | 17 | 2700 | 3 | 67 | 24 | 1100 | Kala Oya |

Chemical Results of the Sampled Well Water NDC -- HCO₃ Subgroup

| Loca- tion No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCO ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hard- ness ppm in CaCO ₃ | Fe ppb | Mn ppb | Total Cu ppb | Total V ppb | Co ppb | Zn ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SiO ₂ ppm | F ppb | Topographic Sheet | |
|----------------------|-----------|-----------|-----------|----------|-------------------------|------------------------|-----------|------------|--|-----------|-----------|--------------------|-------------------|-----------|-----------|------------------------|------------------------|------------------------|-------------------------|----------|----------------------|---------------|
| 72 | 20.54 | 14.95 | 11.58 | 3.91 | 104.2 | 34.58 | 17.00 | 200 | 112 | 2920 | 120 | 2 | 7 | 2 | 49 | 2,100 | 62 | 20 | 3 | 380 | Ratnapura | |
| 73 | 32.00 | 12.52 | 28.25 | 0.86 | 117.1 | 68.20 | 12.00 | 260 | 132 | 1980 | 143 | 3 | 1 | 7 | 49 | 1,100 | 51 | 7 | 2 | 320 | " | |
| 74 | 26.00 | 12.52 | 22.10 | 3.91 | 122.0 | 34.50 | 18.00 | 270 | 117 | 2000 | 92 | 3 | 1 | 3 | 47 | 8,000 | 53 | 7 | 7 | 410 | " | |
| 75 | 30.00 | 12.15 | 23.92 | 3.91 | 117.1 | 48.00 | 20.00 | 220 | 127 | 720 | 93 | 11 | 2 | 3 | 52 | 7,920 | 17 | 7 | 1 | 390 | " | |
| 83 | 5.75 | 3.64 | 1.97 | 0.68 | 22.5 | 14.40 | 2.00 | 42 | 27 | 270 | 42 | 12 | 4 | 3 | 10 | 1,700 | 21 | 7 | 3 | 520 | Hapatale | |
| 107 | 5.03 | 3.36 | 9.45 | 3.91 | 44.5 | 0.81 | 10.99 | 79 | 35 | 6860 | 72 | 24 | 3 | 27 | 11 | 11,000 | 27 | 17 | 3 | 420 | Avisavella | |
| 127 | 5.15 | 6.07 | 1.37 | 4.28 | 43.3 | 0.38 | 11.99 | 120 | 48 | 720 | 22 | 17 | 22 | 7 | 21 | 10,000 | 217 | 2 | 11 | 100 | Nuwara Eliya | |
| 133 | 68.00 | 36.00 | 68.90 | 3.48 | 305.0 | 5.81 | 116.01 | 1750 | 320 | 110 | 82 | 7 | 17 | 17 | 12 | 14 | 143 | 50 | 71 | 270 | Ponivil | |
| 164 | 60.00 | 6.76 | 19.99 | 0.39 | 176.9 | 58.00 | 19.00 | 170 | 178 | 2310 | 82 | 2 | 17 | 21 | 43 | 17 | 8,310 | 28 | 327 | 12 | 150 | Kandy |
| 167 | 60.00 | 5.30 | 13.79 | 3.01 | 190.0 | 20.60 | 20.00 | 120 | 172 | 1220 | 22 | 13 | 41 | 11 | 41 | 7,000 | 77 | 312 | 7 | 10 | " | |
| 181 | 68.00 | 36.00 | 45.90 | 9.64 | 324.5 | 63.40 | 69.99 | 210 | 320 | 120 | 41 | 10 | 13 | 13 | 13 | 2,100 | 140 | 773 | 2 | 20 | Nilgala | |
| 185 | 67.90 | 36.30 | 22.90 | 4.93 | 312.3 | 7.45 | 2.79 | 145 | 320 | 110 | 41 | 3 | 1 | 1 | 73 | 110 | 28 | 773 | 17 | 2900 | " | |
| 190 | 76.00 | 36.30 | 22.90 | 14.08 | 366.0 | 3.18 | 47.00 | 527 | 340 | 430 | 114 | 7 | 2 | 2 | 130 | 53 | 1,000 | 412 | 1400 | 27 | 2300 | Tirukkowl |
| 191 | 96.40 | 48.40 | 11.40 | 19.55 | 483.2 | 3.84 | 31.99 | 500 | 441 | 520 | 117 | 13 | 3 | 32 | 160 | 77 | 10 | 1700 | 22 | 2100 | " | |
| 193 | 88.00 | 48.40 | 45.90 | 13.69 | 450.4 | 7.76 | 48.00 | 470 | 420 | 110 | 100 | 11 | 8 | 39 | 140 | 12 | 100 | 317 | 4000 | 18 | 2300 | " |
| 217 | 20.00 | 11.40 | 0.22 | 1.01 | 61.0 | 5.76 | 30.00 | 213 | 97 | 900 | 72 | 12 | 1 | 12 | 73 | 211 | 280 | 622 | 1 | 70 | Kurunegala | |
| 241 | 120.00 | 72.00 | 91.90 | 4.10 | 609.5 | 130.60 | 120.00 | 500 | 600 | 780 | 100 | 10 | 14 | 120 | 70 | 110 | 880 | 227 | 722 | 21 | 20 | Maha Oya |
| 245 | 88.00 | 48.00 | 22.90 | 26.20 | 233.8 | 44.10 | 71.99 | 170 | 420 | 120 | 110 | 7 | 1 | 42 | 73 | 211 | 280 | 622 | 1 | 70 | " | |
| 263 | 67.10 | 48.00 | 45.90 | 2.73 | 427.0 | 10.00 | 80.00 | 777 | 368 | 730 | 122 | 18 | 11 | 13 | 31 | 12 | 12,800 | 278 | 22 | 27 | 410 | Wariyapola |
| 265 | 61.00 | 36.00 | 22.90 | 9.15 | 309.3 | 53.30 | 40.00 | 400 | 304 | 720 | 100 | 18 | 2 | 7 | 28 | 22 | 7,200 | 420 | 18 | 42 | 410 | " |
| 267 | 44.80 | 24.00 | 2.29 | 7.12 | 244.0 | 11.30 | 10.00 | 417 | 212 | 110 | 110 | 15 | 2 | 2 | 10 | 3,000 | 417 | 18 | 1 | 400 | " | |
| 277 | 68.00 | 36.00 | 2.29 | 17.75 | 366.0 | 18.70 | 20.00 | 400 | 320 | 120 | 73 | 18 | 10 | 7 | 33 | 210 | 3,200 | 22 | 718 | 22 | 170 | Nalanada |
| 279 | 72.00 | 24.00 | 22.90 | 24.63 | 244.0 | 101.40 | 40.00 | 300 | 280 | 310 | 77 | 13 | 2 | 1 | 41 | 170 | 6,000 | 25 | 514 | 3 | 270 | " |
| 286 | 43.60 | 12.15 | 22.00 | 5.47 | 193.4 | 34.60 | 16.00 | 540 | 159 | 810 | 100 | 18 | 22 | 12 | 42 | 170 | 4,600 | 100 | 332 | 1 | 270 | Elabeiya |
| 294 | 48.00 | 12.51 | 22.00 | 23.86 | 189.7 | 68.20 | 17.00 | 370 | 170 | 610 | 77 | 18 | 2 | 2 | 65 | 317 | 10,000 | 114 | 471 | 5 | 230 | " |
| 299 | 60.10 | 46.30 | 22.00 | 18.65 | 354.6 | 101.40 | 12.98 | 341 | 341 | 110 | 140 | 12 | 3 | 8 | 61 | 320 | 4,300 | 50 | 112 | 2 | 100 | " |
| 300 | 63.70 | 36.40 | 2.29 | 5.86 | 330.6 | 63.40 | 10.99 | 342 | 342 | 430 | 122 | 12 | 2 | 2 | 80 | 420 | 5,000 | 62 | 73 | 18 | 7000 | " |
| 302 | 97.60 | 48.60 | 2.29 | 30.93 | 477.1 | 63.40 | 21.99 | 4444 | 444 | 120 | 75 | 17 | 1 | 1 | 69 | 321 | 6,000 | 17 | 172 | 11 | 320 | " |
| 435 | 300.00 | 60.00 | 1678.00 | 23.85 | 1043.9 | 14.80 | 2700.00 | 2100 | 970 | 320 | 40 | 4 | 2 | 2 | 20 | 31 | 720 | 28 | 100 | 31 | 1000 | Puliyankulam |
| 439 | 220.00 | 109.00 | 91.00 | 25.42 | 982.9 | 44.10 | 270 | 4000 | 1000 | 380 | 22 | 12 | 17 | 17 | 31 | 1,000 | 12 | 327 | 28 | 2400 | Padaviya | |
| 440 | 208.00 | 97.00 | 160.00 | 22.29 | 1060.4 | 5.20 | 300 | 3000 | 920 | 700 | 21 | 12 | 2 | 7 | 117 | 32 | 1,100 | 62 | 427 | 27 | 3000 | " |
| 441 | 204.00 | 109.00 | 229.00 | 35.19 | 1036.7 | 44.10 | 420 | 3200 | 960 | 700 | 22 | 11 | 7 | 1 | 117 | 70 | 1,210 | 17 | 426 | 37 | 2600 | " |
| 447 | 140.00 | 11.54 | 206.00 | 30.50 | 122.0 | 33.00 | 530 | 630 | 386 | 360 | 275 | 21 | 7 | 7 | 61 | 25 | 7,500 | 27 | 42 | 3 | 1200 | Galgamuwa |
| 306 | 68.00 | 24.31 | 68.00 | 0.39 | 206.8 | 48.07 | 141 | 270 | 270 | 270 | 110 | 3 | 22 | 22 | 112 | 72 | 110 | 1 | 92 | 61 | 3270 | Rukam |
| 360 | 100.00 | 7.90 | 91.00 | 19.55 | 311.0 | 20.17 | 163 | 592 | 283 | 1000 | 17 | 7 | 27 | 27 | 17 | 10 | 720 | 38 | 751 | 24 | 780 | Horowaputana |
| 367 | 100.00 | 6.24 | 114.00 | 5.86 | 305.0 | 34.58 | 176 | 516 | 276 | 110 | 340 | 2 | 113 | 13 | 18 | 120 | 120 | 32 | 313 | 22 | 270 | Anuradhapura |
| 372 | 91.00 | 12.15 | 91.00 | 15.01 | 263.5 | 39.38 | 170 | 322 | 278 | 270 | 21 | 3 | 42 | 2 | 70 | 227 | 220 | 7 | 277 | 27 | 1200 | Kaudulla |
| 373 | 76.00 | 24.31 | 45.00 | 12.94 | 244.0 | 34.58 | 119 | 319 | 292 | 110 | 27 | 2 | 117 | 1 | 72 | 222 | 110 | 12 | 327 | 17 | 3000 | " |
| 374 | 70.00 | 36.46 | 45.00 | 33.47 | 287.9 | 34.56 | 139 | 342 | 327 | 430 | 21 | 13 | 2 | 2 | 413 | 17 | 210 | 17 | 217 | 14 | 2700 | " |
| 375 | 124.00 | 24.31 | 183.00 | 21.54 | 433.8 | 58.11 | 300 | 429 | 412 | 130 | 22 | 13 | 117 | 1 | 63 | 317 | 410 | 27 | 312 | 17 | 3200 | " |
| 403 | 140.00 | 8.97 | 27.00 | 28.15 | 427.0 | 8.26 | 890 | 890 | 412 | 2000 | 17 | 2 | 17 | 22 | 27 | 2 | 1000 | 14 | 17 | 42 | 1000 | Medawachchiya |
| 423 | 208.00 | 133.00 | 44.00 | 77.00 | 776.0 | 34.00 | 2000 | 2000 | 170 | 700 | 28 | 1 | 22 | 1 | 27 | 27 | 1000 | 20 | 113 | 41 | 900 | Vavuniya |
| 424 | 202.00 | 156.00 | 22.98 | 106.00 | 410.0 | 596.00 | 2100 | 2100 | 1150 | 780 | 31 | 1 | 1 | 27 | 22 | 73 | 2,700 | 24 | 431 | 27 | 950 | " |

Chemical Results of the Sampled Well Water NDC – NDA Subgroup

| Loca- tion No. | Ca ppm | Mg ppm | Na ppm | K ppm | HCC ₃ ppm | SO ₄ ppm | Cl ppm | TDS ppm | Total Hard- ness ppm in CaCO ₃ | Total Fe ppb | Mn ppb | Total Cr ppb | Co ppb | Total V ppb | Cu ppb | Zn ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SiO ₂ ppm | F ppb | Topographic Sheet | |
|----------------------|-----------|-----------|-----------|----------|-------------------------|------------------------|-----------|------------|--|--------------------|-----------|--------------------|-----------|-------------------|-----------|-----------|------------------------|------------------------|------------------------|-------------------------|----------|----------------------|----------|
| 27 | 84.00 | 80.16 | 2.29 | 27.45 | 319.2 | 101.00 | 60.00 | 442 | 412 | 1700 | 145 | 2 | 7 | 9 | 7 | 22 | 410 | 37 | 38 | 38 | 300 | Ambalantota | |
| 30 | 216.00 | 120.24 | 1333.33 | 35.19 | 616.8 | 101.00 | 2150.00 | 712 | 617 | 210 | 112 | 7 | 12 | 2 | 11 | 72 | 710 | 72 | 21 | 21 | 1800 | Hambantota | |
| 84 | 2.00 | 2.90 | 2.82 | 3.36 | 12.2 | 4.80 | 8.00 | 43 | 32 | 20 | 42 | 7 | 8 | 2 | 17 | 317 | 700 | 27 | 2 | 2 | 1 | 810 | Haputale |
| 85 | 6.79 | 2.43 | 2.90 | 2.73 | 19.5 | 5.28 | 10.00 | 47 | 17 | 120 | 42 | 8 | 3 | 4 | 3 | 318 | 6,000 | 100 | 7 | 10 | 270 | " | |
| 94 | 28.00 | 1.21 | 9.13 | 3.91 | 43.3 | 4.80 | 41.00 | 500 | 120 | 110 | 61 | 3 | 3 | 3 | 7 | 315 | 110 | 120 | 1 | 27 | 3200 | Buttala | |
| 95 | 68.00 | 2.43 | 22.94 | 31.51 | 183.0 | 9.60 | 78.00 | 470 | 270 | 120 | 70 | 13 | 2 | 1 | 9 | 611 | 210 | 131 | 2 | 2 | 1390 | " | |
| 109 | 20.00 | 8.38 | 13.10 | 7.82 | 56.7 | 44.00 | 21.00 | 142 | 85 | 2700 | 40 | 1 | 1 | 82 | 41 | 112 | 2,000 | 82 | 21 | 7 | 270 | Avissawella | |
| 110 | 8.01 | 0.38 | 3.91 | 3.91 | 25.0 | 0.48 | 17.00 | 99 | 36 | 6000 | 42 | 9 | 1 | 87 | 40 | 117 | 1,000 | 87 | 17 | 2 | 170 | " | |
| 111 | 20.00 | 0.07 | 22.98 | 2.29 | 61.0 | 4.41 | 7.00 | 78 | 53 | 4200 | 42 | 2 | 3 | 2 | 71 | 70 | 1,700 | 120 | 11 | 13 | 70 | Hatton | |
| 116 | 20.00 | 4.35 | 8.96 | 11.73 | 57.4 | 16.01 | 11.99 | 112 | 68 | 820 | 22 | 3 | 3 | 7 | 62 | 172 | 2,700 | 170 | 11 | 2 | 10 | " | |
| 119 | 20.00 | 6.29 | 22.98 | 13.31 | 61.0 | 3.50 | 40.00 | 103 | 76 | 2100 | 27 | 2 | 1 | 1 | 1 | 10 | 7,000 | 890 | 12 | 11 | 170 | " | |
| 123 | 8.79 | 4.86 | 18.39 | 3.85 | 37.8 | 2.92 | 18.00 | 114 | 42 | 10 | 12 | 12 | 17 | 1 | 10 | 320 | 2,100 | 327 | 4 | 12 | 10 | Nuwara Eliya | |
| 125 | 20.00 | 2.65 | 16.09 | 3.51 | 50.0 | 3.41 | 17.00 | 119 | 61 | 10 | 20 | 2 | 2 | 3 | 13 | 337 | 10,000 | 118 | 1 | 27 | 70 | " | |
| 131 | 100.00 | 16.94 | 68.96 | 29.01 | 305.0 | 1.63 | 170.00 | 2000 | 320 | 120 | 74 | 9 | 14 | 2 | 17 | 21 | 100 | 17 | 75 | 70 | 20 | Potruvil | |
| 138 | 40.00 | 4.83 | 22.98 | 32.98 | 61.0 | 5.81 | 71.00 | 175 | 120 | 6120 | 112 | 10 | 22 | 3 | 10 | 22 | 7,000 | 70 | 12 | 11 | 20 | Negombo | |
| 141 | 60.00 | 6.27 | 68.96 | 5.31 | 183.0 | 8.26 | 71.00 | 275 | 170 | 3300 | 20 | 12 | 170 | 3 | 9 | 90 | 12,000 | 110 | 9 | 7 | 170 | Gampaha | |
| 182 | 60.00 | 12.10 | 45.97 | 10.16 | 128.1 | 25.79 | 79.00 | 210 | 127 | 120 | 78 | 8 | 2 | 13 | 28 | 37 | 1,100 | 17 | 774 | 30 | 980 | Nilgala | |
| 193 | 60.00 | 6.53 | 45.97 | 39.09 | 128.1 | 8.57 | 140.00 | 170 | 200 | 70 | 70 | 2 | 117 | 7 | 14 | 17 | 7,000 | 112 | 19 | 1 | 230 | Dandagamuwa | |
| 204 | 40.00 | 10.85 | 45.98 | 21.12 | 122.0 | 3.88 | 90.00 | 210 | 145 | 720 | 63 | 11 | 2 | 1 | 43 | 46 | 9,400 | 16 | 27 | 8 | 920 | " | |
| 205 | 20.00 | 12.07 | 12.55 | 11.73 | 61.0 | 3.87 | 30.00 | 210 | 100 | 320 | 64 | 12 | 13 | 1 | 41 | 22 | 2,400 | 6 | 22 | 7 | 990 | " | |
| 209 | 20.00 | 8.92 | 10.11 | 15.64 | 122.0 | 2.86 | 30.00 | 200 | 100 | 880 | 64 | 7 | 2 | 27 | 49 | 38 | 5,400 | 777 | 17 | 2 | 90 | Kurunegala | |
| 212 | 40.00 | 2.63 | 30.57 | 1.96 | 128.1 | 0.46 | 80.00 | 178 | 111 | 1720 | 71 | 10 | 17 | 17 | 80 | 11 | 3,600 | 210 | 42 | 12 | 110 | " | |
| 218 | 20.00 | 10.18 | 2.29 | 5.70 | 56.1 | 15.36 | 30.00 | 112 | 92 | 720 | 67 | 11 | 2 | 18 | 52 | 27 | 3,600 | 342 | 34 | 7 | 270 | " | |
| 220 | 20.04 | 9.70 | 2.29 | 29.17 | 61.0 | 38.00 | 30.00 | 170 | 94 | 110 | 40 | 7 | 2 | 21 | 72 | 32 | 4,800 | 217 | 27 | 2 | 320 | " | |
| 222 | 20.04 | 10.57 | 2.29 | 15.07 | 61.0 | 39.00 | 20.00 | 143 | 94 | 110 | 40 | 7 | 11 | 40 | 59 | 31 | 10,000 | 13 | 42 | 11 | 130 | " | |
| 226 | 20.04 | 4.84 | 2.29 | 18.38 | 7.3 | 5.76 | 40.00 | 122 | 70 | 110 | 42 | 7 | 11 | 40 | 59 | 31 | 10,000 | 13 | 42 | 11 | 130 | " | |
| 229 | 40.08 | 4.83 | 22.98 | 30.97 | 122.0 | 22.00 | 61.00 | 1200 | 520 | 170 | 42 | 7 | 2 | 7 | 77 | 14 | 9,000 | 27 | 22 | 17 | 200 | Kurunegala | |
| 242 | 148.00 | 36.46 | 91.95 | 10.55 | 446.6 | 248.00 | 77.00 | 1200 | 520 | 170 | 42 | 7 | 2 | 7 | 77 | 14 | 9,000 | 27 | 22 | 17 | 200 | Rangala | |
| 266 | 44.02 | 24.31 | 45.97 | 6.84 | 194.6 | 58.00 | 70.00 | 427 | 210 | 430 | 124 | 18 | 1 | 1 | 32 | 21 | 2,600 | 22 | 31 | 31 | 390 | Wariyapola | |
| 269 | 40.00 | 6.52 | 22.98 | 27.61 | 122.0 | 13.00 | 70.00 | 300 | 127 | 430 | 120 | 22 | 1 | 43 | 18 | 18 | 8,400 | 511 | 2 | 2 | 560 | " | |
| 271 | 40.00 | 5.32 | 45.97 | 45.97 | 123.2 | 63.00 | 39.00 | 312 | 122 | 140 | 140 | 11 | 1 | 47 | 22 | 22 | 2,000 | 227 | 1 | 1 | 520 | " | |
| 272 | 62.00 | 6.15 | 45.97 | 22.68 | 151.9 | 63.00 | 70.00 | 1317 | 131 | 122 | 122 | 27 | 3 | 77 | 21 | 3,000 | 317 | 1 | 1 | 1 | 1 | " | |
| 283 | 20.00 | 12.13 | 2.29 | 7.89 | 43.3 | 48.00 | 20.00 | 400 | 100 | 10 | 170 | 12 | 22 | 17 | 37 | 17 | 6,000 | 27 | 772 | 3 | 10 | Nalanda | |
| 287 | 96.00 | 24.31 | 68.96 | 24.24 | 217.8 | 154.00 | 72.00 | 500 | 340 | 170 | 120 | 12 | 77 | 24 | 84 | 413 | 120 | 432 | 12 | 320 | 432 | Elahera | |
| 289 | 87.97 | 24.31 | 45.97 | 26.20 | 217.8 | 101.00 | 119.00 | 400 | 320 | 310 | 120 | 17 | 11 | 7 | 84 | 217 | 122 | 337 | 18 | 20 | 20 | " | |
| 295 | 40.00 | 9.69 | 22.98 | 21.96 | 122.0 | 86.00 | 27.00 | 470 | 140 | 730 | 78 | 19 | 2 | 3 | 64 | 310 | 130 | 712 | 3 | 3 | 100 | " | |

Chemical Results of the Sampled Well Water (Un Classified data)

| Location Number | TDS ppm | Total Hardness ppm as CaCO ₃ | Total Cr ppb | Cl ppm | Fe ppb | Mn ppb | Zn ppb | Co ppb | NO ₃ ppb | NO ₂ ppb | NH ₄ ppb | SiO ₂ ppm | Cu ppb | Total V ppb | F ppb | Topographic Sheet |
|-----------------|---------|---|--------------|--------|--------|--------|--------|--------|---------------------|---------------------|---------------------|----------------------|--------|-------------|-------|-------------------|
| 13 | 330 | 317 | 21 | 135 | 2320 | 42 | 17 | 27 | 7,100 | 62 | 27 | 17 | 42 | 28 | 60 | Morawaka |
| 14 | 320 | 312 | 17 | 350 | 3000 | 72 | 18 | 2 | 10,000 | 28 | 30 | 62 | 12 | 20 | 100 | " |
| 20 | 1100 | 4170 | 3 | 465 | 1780 | 71 | 27 | 7 | 110 | 57 | 92 | 27 | 5 | 30 | 1000 | Ambalantota |
| 71 | | 113 | 1 | 10 | 2000 | 98 | 18 | 11 | 8,000 | 27 | 62 | 9 | 43 | 2 | 170 | Ratnapura |
| 81 | 30 | | 3 | 14 | 10 | 45 | 312 | 3 | 820 | 22 | 11 | 2 | 10 | 3 | 820 | Haputale |
| 96 | 1200 | 270 | 14 | 89 | 720 | 62 | 217 | 1 | 820 | | 11 | 12 | 17 | 8 | 2070 | Buttala |
| 112 | 32 | 40 | 10 | 3 | 1110 | 40 | 77 | 7 | 3,700 | 127 | 62 | 17 | 51 | 3 | | Hatton |
| 189 | 540 | 370 | 7 | 37 | 730 | 122 | 71 | 11 | 710 | 317 | 1270 | 47 | 160 | 72 | 2700 | Tirukkovil |
| 215 | 117 | 211 | 6 | 80 | 1720 | 66 | 120 | 3 | 5,400 | 411 | 27 | 1 | 53 | 21 | 130 | Kuruneegala |
| 228 | 173 | 97 | 2 | 20 | 110 | 44 | 120 | 1 | 8,000 | 17 | 27 | 8 | 3 | 100 | " | |
| 235 | 200 | 44 | 17 | 10 | 720 | 42 | 318 | 2 | 4,000 | 27 | 522 | 12 | 14 | 117 | 130 | Rangala |
| 247 | 272 | 440 | 10 | 17 | 170 | 122 | 112 | 12 | 10 | 627 | 627 | 7 | 87 | 67 | 110 | Maha Oya |
| 249 | 270 | 240 | 17 | 17 | 600 | 120 | 170 | 2 | 11,700 | 322 | 322 | 5 | 67 | 320 | 920 | " |
| 254 | 700 | 540 | 1 | 327 | 620 | 80 | 132 | 7 | 10,200 | 127 | 270 | 2 | 140 | 32 | 410 | Kalmunai |
| 274 | 720 | 340 | 21 | 190 | 110 | 72 | 12 | 117 | 5,600 | 17 | 712 | 11 | 34 | 27 | 140 | Nalanda |
| 311 | 420 | 422 | 2 | | 500 | 120 | 313 | 11 | 32 | | 22 | 3 | 91 | 338 | 3200 | Rukam |
| 315 | 1512 | 712 | | 188 | 400 | 160 | 17 | 1 | 1,100 | 12 | 4200 | | 41 | 7 | 400 | Puttalam |
| 320 | 700 | 217 | 7 | 680 | 640 | 300 | 77 | 22 | 2,400 | 75 | 28 | 3 | 21 | 7 | 130 | Dambulla |
| 329 | 720 | 356 | 20 | 320 | 10 | 38 | 34 | 11 | | 31 | 17 | 3 | 72 | 17 | 720 | Polonnaruwa |
| 331 | 670 | 342 | 12 | 117 | 120 | 82 | 522 | 13 | 610 | 37 | 27 | 7 | 70 | 47 | 10020 | Polonnaruwa |
| 336 | 811 | 268 | 8 | 1400 | 3400 | 270 | 210 | 127 | 200 | 32 | 114 | 112 | 162 | 113 | 2000 | Vakaneri |
| 384 | | 361 | 8 | 100 | 4300 | 440 | 422 | 21 | nd | 17 | 73 | 21 | 198 | 2 | 3300 | Kathiraveli |
| 397 | | | | | | | | | | | | | | | 4000 | Anuradhapura |
| 398 | | | | | | | | | | | | | | | 3100 | Kala Oya |
| 399 | | | | | | | | | | | | | | | 4500 | " |
| 406 | 1000 | 620 | 2 | 72 | 20 | nd | 12 | 21 | 2,110 | 91 | 27 | 27 | 27 | 43 | 500 | Horowpatana |
| 434 | 2130 | 700 | 3 | 1720 | 560 | 40 | 42 | 1 | 820 | 22 | 100 | 27 | 10 | 3 | 750 | Puliyankulam |