Ground Water Evaluation in Soro Town Ganjuwa L.G.C.

By

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GROUND WATER EVALUATION IN SORO TOWN GANJUWA LGC

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Certification

This project entitled " Groundwater Evaluation in Soro Town Ganjuwa LGC," which was carried out by Yacoub Hassaballah has met the requirement for the award of the degree of Bachelor of Technology (Applied Geology) of Abubakar Tafawa Balewa University.

Mr. Isa. M. T.

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Programme Coordinator

External Examiner

Name

Signature

Date

Dedication

This project work is dedicated to my late parents: Mahamat Nour Hassaballah and Kaltouma Dacko.

May Allah grant them Paradise.

Amin.

Acknowledgement

Glory be to Allah for His strength, guidance, endurance and courage given to me during my stay in Nigeria and particular in this university.

My sincere gratitude goes to my supervisor for his constructive criticism, guidance and suggestion for the success of this work.

I would like to thank the entire geology lecturers:Prof Dike,Prof Dada, Prof Orazulike, M.B.Abubakar, Ahmed I.Haruna, Tukkur, , N.K.Samaila, Isa M.T without whom my training to become a geologist would not have been possible.

I also want to thank my uncles Adogo Yacouba, Adoum Mahamat, Mahamat Ahmat Azaari, Adoum Yacouba, Alh Ahmat Dana for their financial and moral supports.

Special thanks goes to my brothers, sisters and relatives.

Lastly I really appreciate the help of my classmate Abdullahi Moh' Adamu, my room mates Alaina Possey, Ahmad Hamit, Diallo Moussa, Fabien D.D.

Abstract

The research area lies between longitude $10^0 15'$ and $10^0 30'$ and latitude $11^0 00'$ and $10^0 45'$ in Soro Town Ganjuwa LGC. The work is based on the chemical and bacteriological analysis of the ground water in Soro Town collected from hand dug wells and one hand pump well. The results were evaluated with a view to determine the quality in terms of the chemistry and bacteriological contents of the ground water in the area. The cations and anions are high in some areas, e.g: Cu^{2+} ,

Mg^{2+} , Ca^{2+} are very high in Anguwa Kasa; NO^-_3, F^- are very high in Sabon Kawra and Ammagala. The bacteriological content is alarmful in Sabon Kaura. The population of Soro Town suffer from scarcity of water, the only source of water is obtained from ground water; consequently this scarcity exposes the people to drink unsafe water.

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CHAPTER ONE

1.0 INTRODUCTION

Water is the single most important agent after air. It is undoubtedly the most precious natural resource that exists in our plant. It occurs as surface water in streams, pounds, rivers, lakes and seas and also as ground water when it accumulates in the ground.

Table 1 below shows the distribution of water in hydrosphere indicating the relatively little fresh water on the earth. Most of the fresh water is locked up as mainly in the large polar ice cap however, not all ground water is a fresh water. The necessity of fully utilizing all available water resources become more and more important; all over the world population depends on ground water and/or surface water. Unlike surface water which can be quantified and managed accordingly, ground water reserves can only be quantified indirectly and with varying degree of uncertainly according to the available knowledge of geographical characteristics of the aquifer concerned.

The quality of drinking water is determined by its physical, chemical and bacteriological contents.

Table 1: Water in the Hydrosphere

Reservoir	Percentage of total water	Percentage of fresh water	Percentage of unfrozen fresh water
Oceans	97.54	-	-
Ice	1.82	73.9	-
Groundwater	0.63	25.7	98.4
Lakes and stream			
Salt	0.007		
Fresh	0.009	0.35	1.4
Atmosphere	0.001	0.04	0.2

Data from J. R. Mather, water resources 1984

The major ions that are commonly analyzed for domestic and agricultural uses include Na^+, Ca^{2+}, Cu^{2+}, Mg^{2+}, Fe^{2+} (t), Cl^-, F^-, NO_3^-, SO_4^{3-} and PO_4^{3-}, other parameters include pH, temperature conductivity, TDS and turbidity.

These elements if taken in very low or high concentration can cause health hazard as notified by Dissanayake and Chandrajith (1999) that podoconiosis or non-tilarial Elephantitis affects large population in Ethiopia, Kenya, Tanzania, Rwanda Burundi, Cameroon and the Cape Verde Island. These areas were consistently associated with red clay soils. Analysis of lymph nodes from diseases tissues showed the present of micro-particles consisting predominantly of aluminum, silicon and titanium.

Since water in the study area is mainly from the ground, it becomes obvious that it could be contaminated through several means e.g surface run off from dump refuse it is important to carry out analysis to know the health status of the water. Ten sources of water: nine from well and one from hand pump well were examined to determine the water quality of Soro town Ganjuwa L.G.C. Fig 1 showing the sampling points

1.1 AIMS AND OBJECTIVES OF THE STUDY AREA

The aims and objectives of the study are:

- To determine the suitability of the ground water in Soro for drinking and agricultural uses.
- To determine the sources of impurities and if possible come up with solutions to the problem.
- To provide basic information for organization interested in the development of ground water resource in the area.

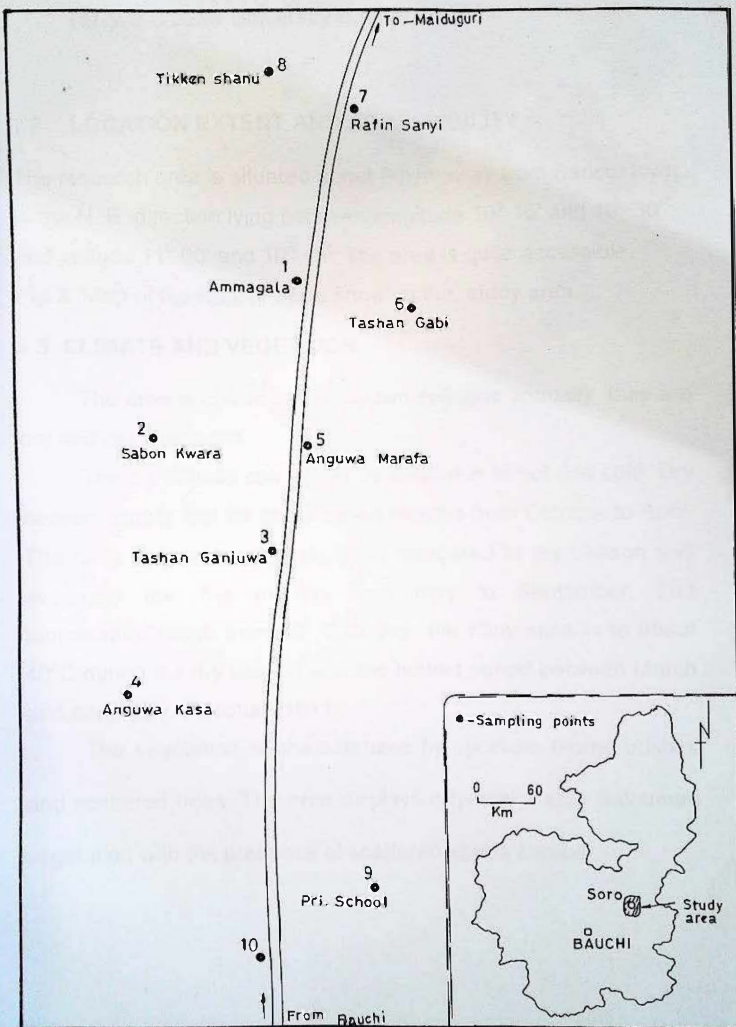


Fig. 1 Map showing the sampling points.

- It is also part of the requirement for the award of the degree of bachelor of technology in Applied geology of Abubakar Tafawa Balewa University Bauchi.

1.2 LOCATION EXTENT AND ACCESSIBILITY :-

The research area is situated about 80km away from Bauchi town in the N. E. direction lying between longitude 10° 15' and 10° 30' and latitude 11° 00' and 10° 45'. The area is quite accessible.

Fig 2 Map of the Bauchi State showing the study area

1.3. CLIMATE AND VEGETAION

The area is characterized by two seasons annually; they are dry and rainy seasons.

The dry season can further be divided in to hot and cold. Dry season usually last for about seven months from October to April. The rainy season is relatively short compared to dry season and averagely last five months from may to September. The temperature range from 30^0 C during the rainy season to about 40°C during the dry season with the hottest period between March and early May, Falconer (1911).

The vegetation is characterized by sporadic thorny bushes and scattered trees. The area displays a typical Sudan Savannah vegetation with the presence of scattered shorts shrubs.

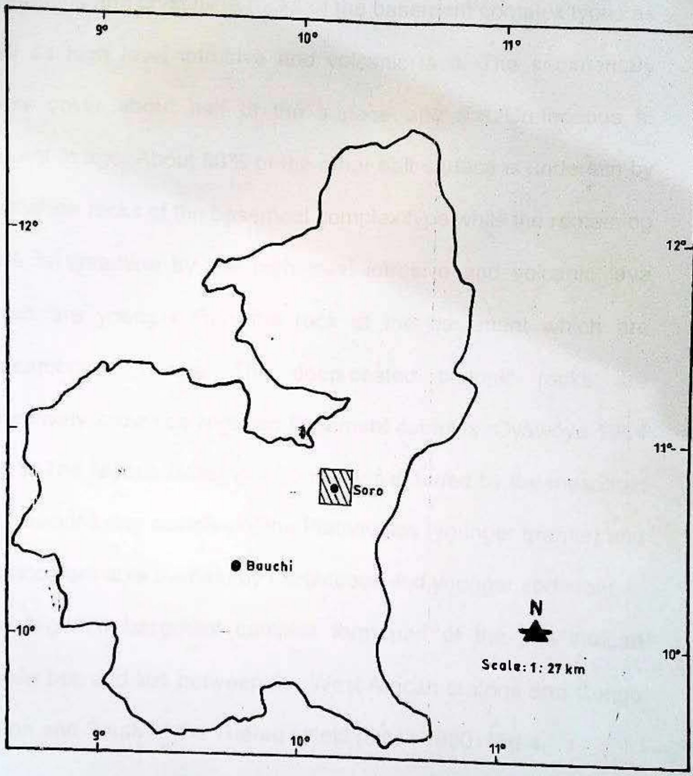


Fig.2: Map of Bauchi State showing the study area.

CHAPTER TWO

2.0 GENERAL GEOLOGY

The geology of Nigeria consists broadly of sedimentary formations and crystalline rocks of the basement complex types as well as high level intrusive and volcanic lava. The sedimentary rocks cover about half of the surface and are Cretaceous to Recent in age. About 80% of the other half surface is underlain by crystalline rocks of the basement complex type while the remaining 20% is underline by the high level intrusive and volcanic lava which are younger than the rock of the basement which are Precambrian in age. The deep-seated plutonic rocks are collectively known as Nigerian Basement complex, Oyawoye 1964 **Fig 3**. The Nigeria Basement Complex is intruded by the mesozoic calc alkaline ring complex of the Plateau Jos (younger granite) and is unconformable overlain by Cretaceous and younger sediment.

The Nigerian basement complex form part of the pan African mobile belt and lies between the West African cratons and Congo craton and South of the Tuareg shield (black 1980) **Fig 4**.

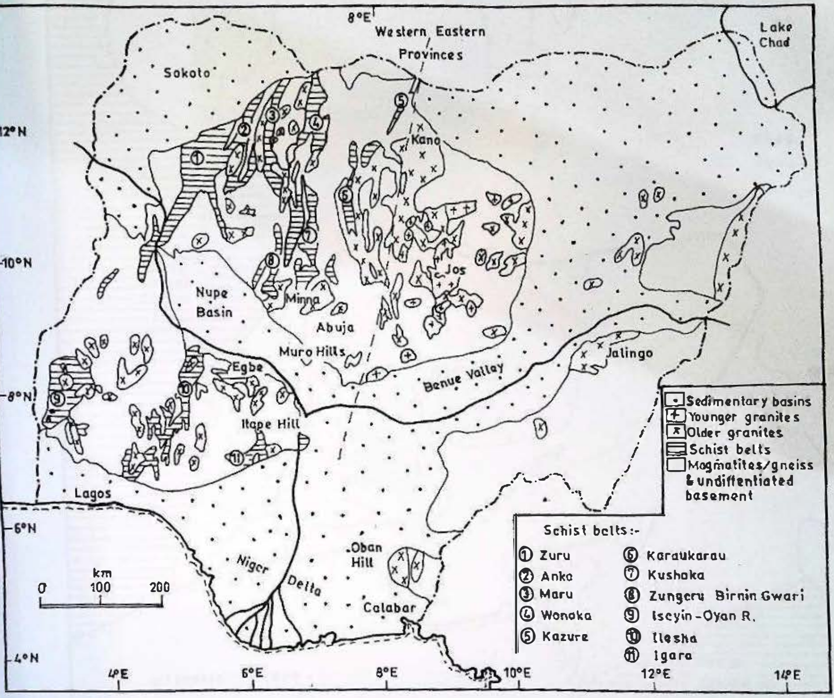


Fig 3: Outline geological map of Nigeria

Rahaman; Woakes and Ajibade,(1986).

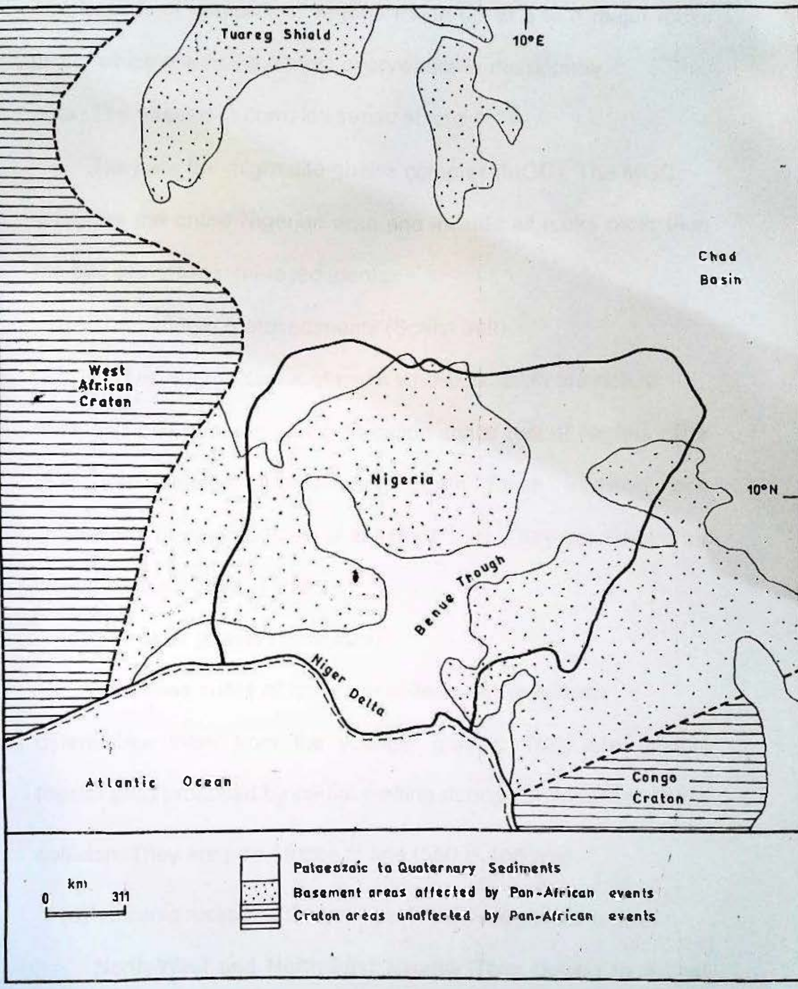


Fig.4: Regional geological setting of Nigeria.

Source: Woakes, Rahaman & Ajibade (1989).

The basement complex of Nigeria made up of 3 to 4 major rocks group which are found almost everywhere in the country.

(a) The basement complex sensu stricto

They are the migmatite gneiss complex (MGC). The MGC underlies the entire Nigerian area and include all rocks older than the late proterozoic metasediments.

(b) The younger metasediments (Schist belt)

They are the series of rocks whose protolith are rich in mica and can be seen in the so called schist belt of Nigeria. The form well defined approximately North South trending belt extensively developed West of longitude 8° E. They are formed by metamorphism of other rocks.

(c) The older granite (sensulato)

These suites of rocks are called older granite to differentiate them from the younger granite. They are granite (sensu late) produced by partial melting during continent-continent collision. They are pan African in age (550 ± 108 ma)

(d) Volcanic rocks are the youngest rock recognized in both North-West and North-East Nigeria. They belong to a post older granite episode of high level magmatic activity. Preliminary age determination suggest that these rocks were intruded during epeirogenic uplift and fracturing the final stages of the pan Africa orogeny.

2.1 Ground Water Resources as it Related to the Geology of the Area.

The study area is underlain by crystalline basement rock and are known to be a poor aquifer; this is because they are very hard with a very low permeability hence not water bearing. However, despite its poor hydrological characteristics these rocks are still very important in ground water development in Nigeria. this is because the limited ground water occurrence found in the weathered and fractured zones within the rock provide a lot of a water needed in the rural areas in over 50% of the country.

The porosity of rocks determines its hydrological properties as this depends on the texture and mineralogy of the rocks. In fresh, non-fractured crystalline rocks the porosity is often less than 3%. However, this can increase considerably by fracturing or weathering. Volcanic rocks show varied porosity. While dense basalt has porosity of 1% or less; pumice is known to have porosity of up to 85%. Despite such high porosity, the permeability depends on the degree of interconnection or linking of the voids/pore space within the rocks. The fractures and joints usually provide the links in the weathered zone, a lot of void space is created and ground water stored therein. The high permeability is found in partly decomposed level below the predominantly clay soil of the bedrock.

2.2 Ground Water Chemistry

Chemically water is the combination of hydrogen (H) and oxygen (O). Since water cannot be found in its purest form in nature. This is because it is affected by the environment and in the formations it accumulates. According Offodile, (2002) he classified the ground water in Nigeria on the basis of the chemical parameters viz anionic and cationic concentration into:

i - Predominantly calcium bicarbonate water

ii - Magnesium sulfate, sodium chloride, calcium bicarbonate water

iii - Predominantly sodium chloride water

iv - Magnesium sulfate water

i. Predominantly calcium Bicarbonate water

Most of the Nigerian ground water fall into this category. The aquifer include carbonate rocks and sandstones in various stage of the consolidation. The high carbonate in water from limestone areas is explicable and can be attribute to the rock type.

But of interest is the fact that most Nigerians sandstone aquifers give high carbonate / bicarbonate chemicals characteristics.

Du Preeze (1975) made a similar observation about ground water from Northern Nigeria.

ii- Magnesium Sulphate sodium chloride calcium Bicaribonate water: -

This types of water is also common. In this group all ions appear to be reasonably represented. Like the bicarbnonate water, this group is fairly wide spread all over the geological formations typical examples appear in the Lafia sandstone aquifers. Some of the water in the deltaic plain have been relatively recent and calcification can said to be limited.

iii- Predominantly Sodium chloride water: -

water of this chemistry are associated with the brine areas of the Benue valley and the coastal area of the country. In the coastal area, some of the aquifers have a contact with sea water and as a result saline contamination or intrusion is a common phenomenon hence the alteration of saline and fresh water horizons.

iv- Magnesium Sulphate water

Very few Nigerian water fall in to this category Offodile (2002) characterized the chemistry of the water of the different aquifer in the Chad basin.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION:

The constituents of ground water reflect the environment of occurrence including geological, biospherical and human influences. In the shallow aquifer of the weathered basement complex would normally be expected to reflect the ground water and the weathering conditions. The methodology includes the collection of samples and analyses of these samples and library consultation to interpret and discuss the samples.

3.1 Collection of Samples

A bottle of 1.5L was thoroughly washed for the collection of water. Nine (9) samples were collection from wells and one (1) from hand pump well. During the collection, the bottles were rinsed twice or more to get a good sampling and using different drawer for each well. For the case of hand pump well, water was left flowing for about 5 minutes before collection. The samples were brought to the laboratory room after the collection.

Fig1 shows the sample collection point in Soro Town.

3.2.0 **Analysis**

These include the analyses of chemical elements in the water sample; and these are physical parameter and chemical parameter which are Na^{+}, Ca^{2+}, Mg^{2+}, Cu^{2+}, Fe^{2+}(T) NO^{-}_{3}, PO^{3-}_{4}, SO^{2-}_{4}, Cl^{-}, and F^{-} and temperature, Ph, conductivity and total dissolved solid (TDS). Bacteriological analyses were also carried out.

Instrumentation

The underlisted instruments was used in the analyses of the water samples :-

i- TDS/conductivity meter (HACH) model 44600-00

ii- Titrimetry – Digital titrator (HACH) model 1699-01

iii- Spectrophotometer (HACH) model Dr/2000.

iv- Palin test ph meter

v- Del aqua analytical kit.

3.2.1. **Determination of Physical Parameters :**

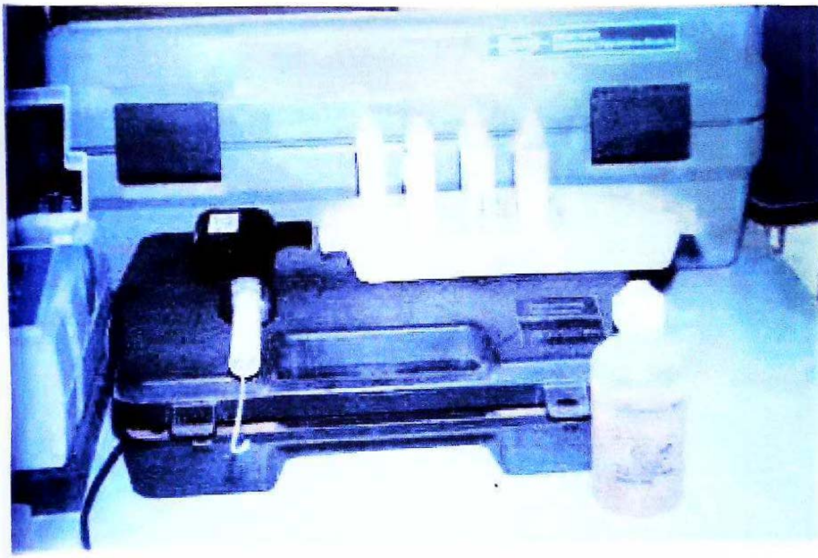
3.2.1.1. **Temperature**

This was done using the direct reading HACH model conductivity/TDS meter, the probe of this instrument was immersed in to the sample and temperature was shown on the screen.

TDS/ Conductivity Meter (Hach model)

DR/2000 Spectrophotometer (Hach model)

Digital Titrator (Hach model) 1699-01



Summit Incubator

3.2.1.2. **Conductivity:**

This is the measured of the amount of ions in the water. This was carried out using TDS/conductivity meter it units is µS/Cm.

3.2.1.3. **Total Dissolved Solids (TDS) (mg/L)**

100ml of each sample was taken and the probe arm of TDS/conductivity meter was immersed in the sample and the results were displayed on the screen.

3.2.1.4. **pH Test**

This is the measure of acidity and basicitiy of the water sample. Palin test was used. Each sample was poured into the palin test comparator equipment and phenol red indicator was then dissolved in the solution. The corresponding values of the color shown were then recorded.

3.2.2 **Determination of Chemical Elements**

3.2.2.1 **Determination of Iron (fe^{2+}) Concentration**

This was determined using Dr/2000 spectrophotometer (HACH model). A standard bottle of 25ml was filled with the sample and Ferrovar reagent of HACH was added. It was left for three minutes for the reaction before being transferred into the spectrophotometer screen and the result is obtained.

3.2.2.2 **Determination of Copper (Cu^{2+})**

25ml of sample was taken at a time and bicinchoniate powder pillow reagent was added to it and then left for two minutes of reaction before being transferred into spectrophotometer. The concentration of Cu^{2+} iron was displayed on the screen.

3.2.2.3 **Determination of SO_4^{2-} Concentration**

Sulvar 4 pillow powder was added to 25ml of the sample and then shook for 20 seconds. It was left for five minutes of reaction being transferred into spectrophotometer and the result is determined.

3.2.2.4 **Determination NO^-_3 Concentration:**

Accuvac plus pillow powder reagent was added to 25ml to each of the samples. It was shook thoroughly and left for 15 minutes of reactions before being transferred into the spectrophotometer for displaying the concentration.

3.2.2.5 **Determination of PO^{3-}_4 Concentration**

3 Pillow powder reagent was added to 25ml of each sample, shook thoroughly for one minute and then left for 2 minutes of reaction. The sample was thereafter taken into the spectrophotometer when the corresponding concentration was displayed.

3.2.2.6. **Determination of Calcium (Ca^{2+})**

Titration method was used to determine the concentration of Ca^{2+}. 50ml of the sample was taken; 1ml of buffer solution was pipettered and added to the 50ml sample. Reagent manver 2 pillow pack was added to the solution sample.

The colour of the solution then changed to Red. The titrant in the digital titrator cartridge was ethylene diamine tetra acetic acid (EDTA). The titrant was then titred with Red color sample solution until the color changed to blue. The value of concentration of the used titrant was read and recorded.

Total hardness as $CaCO_3$ = Titrant value x digit multiplier for 50ml of sample, digit multiplier = 1.0

To get the concentration of Ca^{2+} the value of total hardness was then multiplied by 0.4: this process was carried out for each of the 10 samples.

3.2.2.7 **Determination of Magnesium (Mg^{2+}) ion**

Both $MgCo_3$ and $CaCO_3$ made up the total hardness of water sample. Therefore Mg concentration was calculated using the relation.

Mg. Hardness as $CaCO_3$ mg/L= Total hardness – mg/L Ca

$MgCO_3$ (mg/L) = Mg – hardness as $CaCO_3$ x 0.842.

Mg^{2+} (Mg/L) = $MgCO_3$ (Mg/L) x 0.29

3.2.2.8 **Determination of Alkalinity (Na^+ Cl^-)**

Both the sodium and chlorine constitutes the major alkalinity of the water samples. The individual concentration was determined using titration method. 100ml of each sample was taken and the diphenyl carbozone powder pillow was added and the solution turned yellow cartridge of mercury nitrate ($Hg(No_3)_2$) was used as titrant.

This was titrated with the sample solution and turned from yellow to light pink. The value on digital titrator was recorded and called digits required.

To get Cl^-

Digit required x digit multiplier = Cl^- (mg/L) where digit multiplier is a constant value for different volume of the sample used. For 100ml of sample the digit multiplier is 0.4

To get Na^+

Multiply the concentration of Cl^- by 1.65, which is a standard constant value. For this result we subtracted the concentration of Cl^- from it and left with concentration of Na^+. This was carried out for all other samples and their concentrations were recorded.

3.3.0 **Bacteriological Analyses.**

Instrumentation

i) Dispersal

ii) Petri dish

iii) Incubator

iv) Culture media (Launyl Sulphate Broth)

v) Absorption Pad

vi) Filter membrane

vii) Methanol

viii) Sterilized filtration cup

ix) Tweezer

3.3.1 **Bacterial Organism**

The coliform bacteria monitored are not usually themselves pathogenic but they serve very usefully as indicator organism. If water is free of coliform bacterial, there can be a high degree of confidence that pathogenic organisms are also absent; if they are detected then it is possible that the integrity of water supply system has been compromising and that there must be danger that pathogenic organism are present. According to Lamikanra (1989) coliform bacterial can be divided into three (3) groups.

The first group consists of commensals like *streptococus* feacalis and clostridium, which are not intestinal parasites but their presence, suggest feacal contamination.

The second group of intestinal parasite is the lactose fermenting Gram-negative baccilli; the entro bacteriacea the typical of feacal coliform is *Esterichea coli.* Their presence in water is an indication of recent feacal contamination.

The third groups are pathogens like *Salmonella typhi*, which give rise to extensive morbidity and considerate mortality. Such organism need to be excluded .completely from drinking water. Each detection of coliform bacteria therefore requires detailed investigation to discover the causes so that remedial action can be taken.

3.3.2 **Analyses.**

Before the commencement, all material must be sterilized using methanol. Seven (7) petri dish are put in place; seven pads is then dispersed in each of the seven petri-dishes. 2ml of the prepared medium was taken at a time to soak each of the pads in the petri dishes. $50cm^3$ of the water sample is filtered using a filter membrane. The pathogens are trapped on the filter membrane; this filter is then taken to the absorption pad and covered. The petri dishes are kept in the incubator at 37^0C for about 18 hours. After that, the petri dishes are opened and the number of coliform forming unit was observed with my naked eyes.

CHAPTER FOUR

4.0 RESULTS AND INTERPRETATION

The table II shows the result of the analyses. NB: All the results were compared with the World Health Organization Standard. table 2.

4.1 Physical Parameters:

Temperature: The temperature in the research area falls between 31-32°C. There is no W.H.O standard value for temperature.

pH: The potential hydrogen is the measure of acidity and/or basically. It is within the permissible level i.e. 6.8-8.5

TDS: Total Dissolved Solids

This is the amount of substances dissolved in the water. It affects the appearance of water. In the research area, it varies from one location to another location. Except in locations 5,8 and 9 (refers to the fig. 1) all the other is within W.H.O. standard.

Conductivity: -

This is the presence of ions in the water. The result shows that the conductivity is very high in the study area compared to the W. H. O. standard.

S/NO	PARAMETER	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	W.H.O STANDARD
1	Temp. ^{0}C	32	31.9	31.7	31.8	31.7	31.6	31.6	31.6	31.8	31.8	-
2	PH	7.6	6.8	6.8	7.4	7.6	7.2	6.8	7.6	7.0	7.0	6.8-8.5
3	TDS mg/l	180	620	460	170	11.40	320	560	1210	1720	365	1000
4	CND uS/ cm	355	1245	920	340	2280	650	1120	2415	3455	730	112
5	Ca^{2+} mg/l	91.74	1.78.4	108	72.20	181.3	93.44	133.6	177.5	194.9	82.25	150
6	Mg^{2+} mg/l	39.15	51.8	39.85	37.55	72.30	37.95	46.35	68.8	77.01	28.94	50
7	Cu^{2+} mg/l	0.62	2	1.04	0.16	8.2	0.60	1.99	4.77	6.32	0.94	1.0
8	Fe (T) mg/l	0.04	43	0.04	0.01	0.05	0.04	0.03	0.06	0.05	0.05	0.3
9	Na^{+} mg/l	11.7	0.04	19.37	14.66	24.70	18.92	96.2	68.25	115.7	31.95	200
10	NO_3^{-} mg/l	2.6	85.41	16.2	7.6	70.20	17.4	38.00	53.60	69.20	18.4	45
11	PO_4^{3-}	0.59	39.50	0.55	0.60	0.36	0.43	0.78	0.61	0.50	0.45	10
12	SO_4^{2-} mg/l	11	0.51	22	8	104	25	36	128	140	23	250
13	Cl^{-} mg/l	18	22	29.8	22.55	38	29:11	148	105	178	49.15	250
14	F^{-} mg/l	0.86	131	2.04	2.74	0.40	2.04	2.2	1.54	2.66	1.00	1.50
15	Coliform (Bacteria) cfu	2	1	2	2	2	7	2	2	2	2	3/100 ml

Table III : Result of Analysis

Key:-

CND - Conductive

T.D.S - Total Dissolved Solids

Cfu - Coliform forming unit

S1 Borehole

S2 - Rafin sanyi LI (2)

S3 - Tikken Shanu LI (1)

S4 - Primary School LI (1)

S5 - Anguwan Kasa LI (1)

S6 - Sabon Kaura LI (I)

S7 - Ammagala LI (1)

S8 - Unguwan Marafa LI (2)

S9 - Tashan Ganjuwa LI (1)

S10 - Tashan gabi LI (2)

4.2.0 Chemical Parameters

4.2.1. The cations

These include Na^+, Ca^{2+}, Mg^{2+}, Cu^{2+}, and Fe^{2+} (T)

Na^+

All the samples show an acceptable amount of sodium in the water. The concentration is harmless. **Fig. 5a**

Fe^{2+}, (T).

The concentration of iron (total) is within the permissible level except in the location 2 where is above the standard **Fig 5b.**

Cu^{2+},

The concentration of copper ions is high in half of the sample area the location are 3,5,7,8,9, compared to W.H.O. **Fig.5c**

Mg^{2+}.

Almost the same area show the same characteristics i.e very high concentration of element 3,5,8,9. **Fig. 5d**

Ca^{2+}.

Except in the locations, 2,5,8,9, the remaining water samples water fall within the permissible level. **Fig. 5e**

NB. All the location should be referred to fig. 1

4.2.2. The anions

Cl^-

The concentration of chlorine is within the standard W.H.O. standard .**Fig 6 a**

F^-

The concentration of fluorine is very high in location 2,3,4,6,7,8, and 9. **Fig. 6 b**

PO^{3-}_4

The concentration of phosphate is very high in location 2, the remaining samples are within the permissible standard. **Fig 6 c**

SO^{2-}_4

The concentration of sulphate is low within the permissible level **Fig. 6 d**

NO^-_3

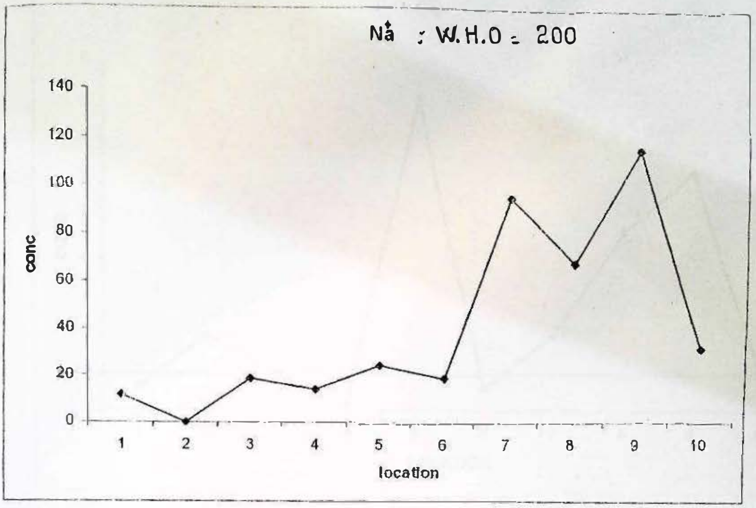
The concentration of nitrate is high in location 2,8,5,9 while the rest are low compared with the standard values **Fig. 6 e**

4.3. 0 Faecal Coliform

The presence of coliform in the research area is low except in the location 6. **Fig 7**

Fig.6 Graphic Representation of the various Cations

(a)



(b)

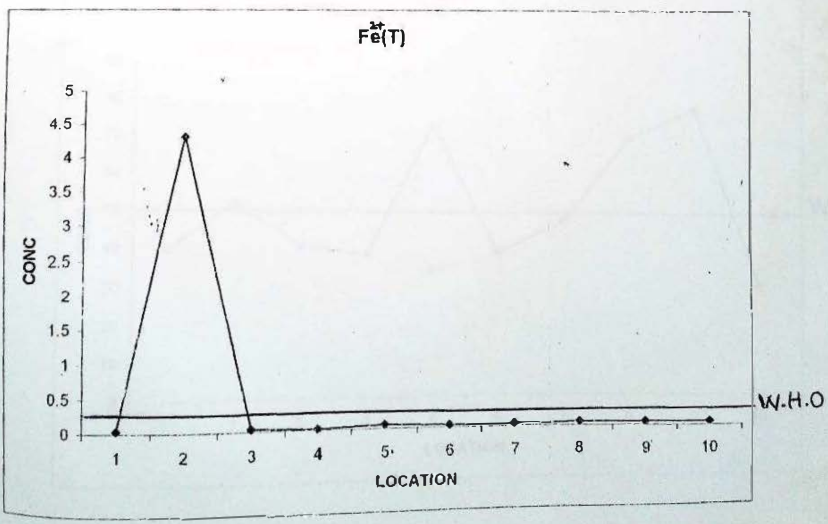
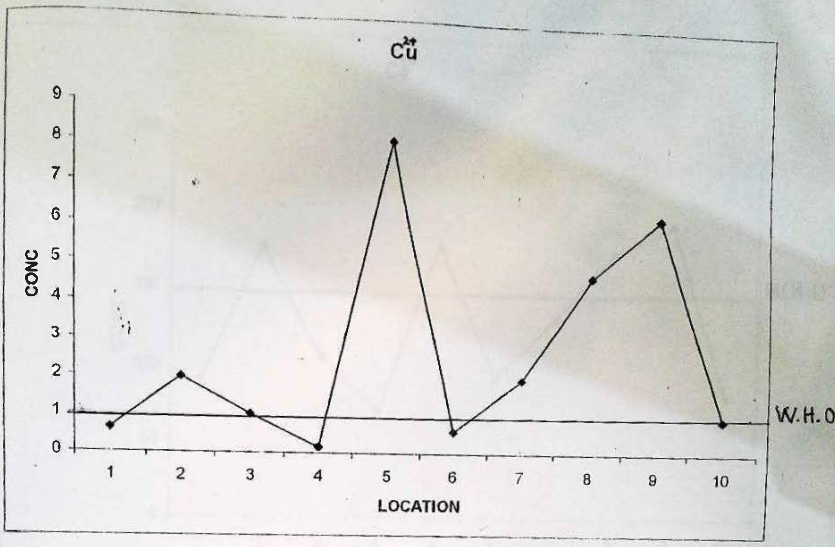


Fig.5

(c)


Cu2+
CONC
0
1
2
3
4
5
6
7
8
9
1
2
3
4
5
6
7
8
9
10
LOCATION
W.H.O

(d)

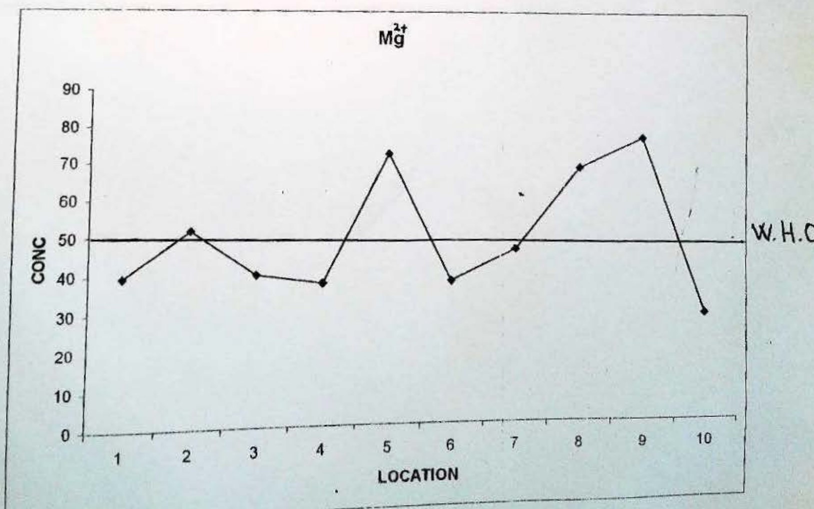

Mg2+
CONC
0
10
20
30
40
50
60
70
80
90
1
2
3
4
5
6
7
8
9
10
LOCATION
W.H.O

Fig.5

(e)

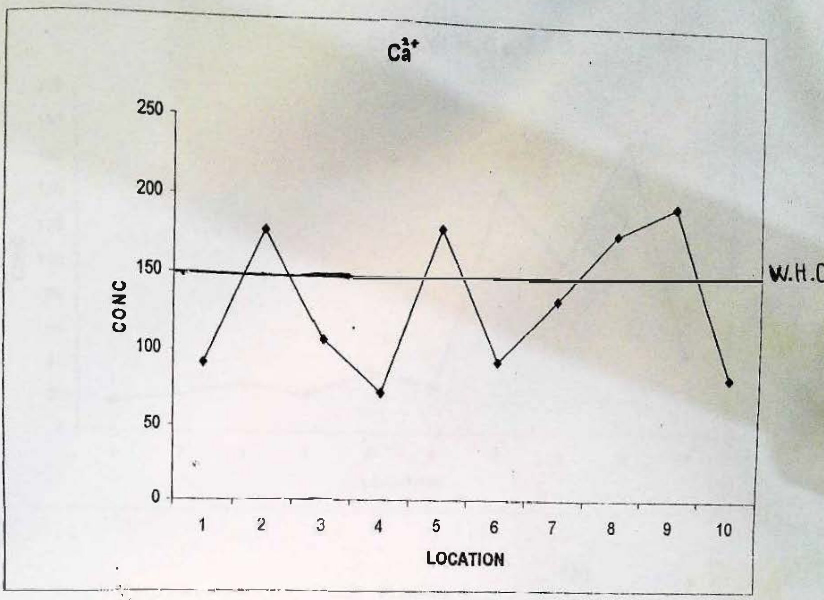
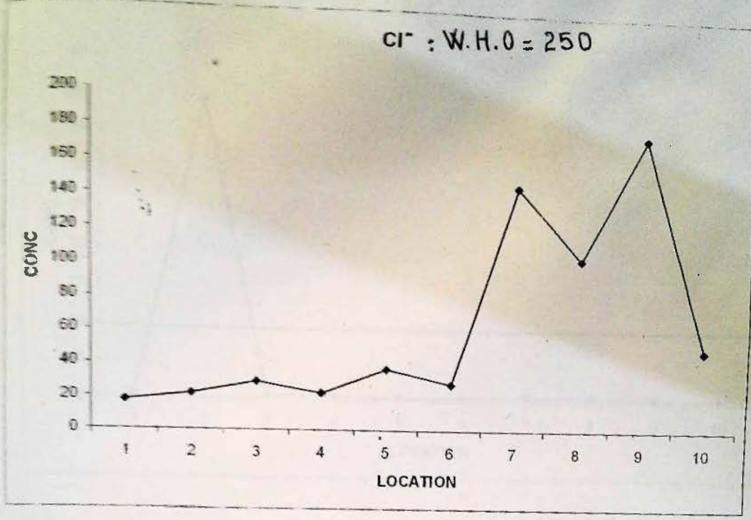


Fig.6 Graphic Representation of the various Anions (a)



(b)

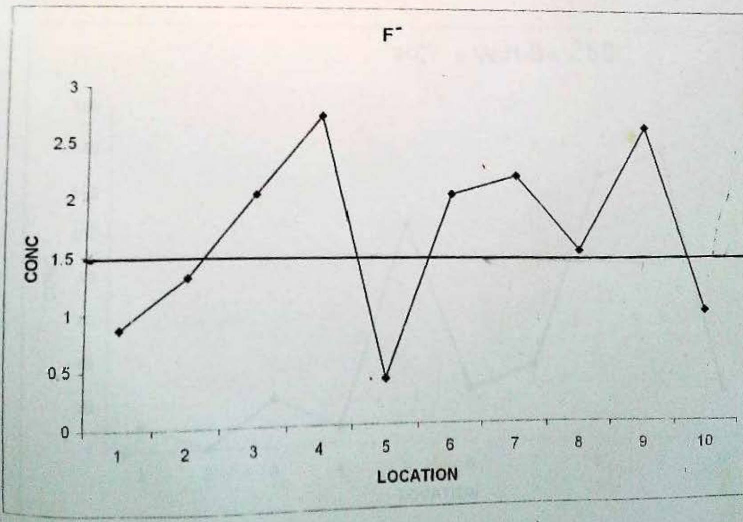
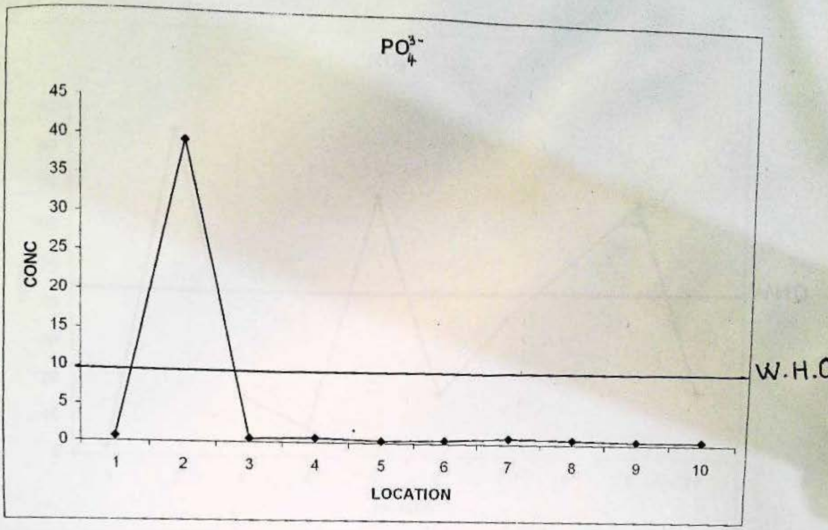


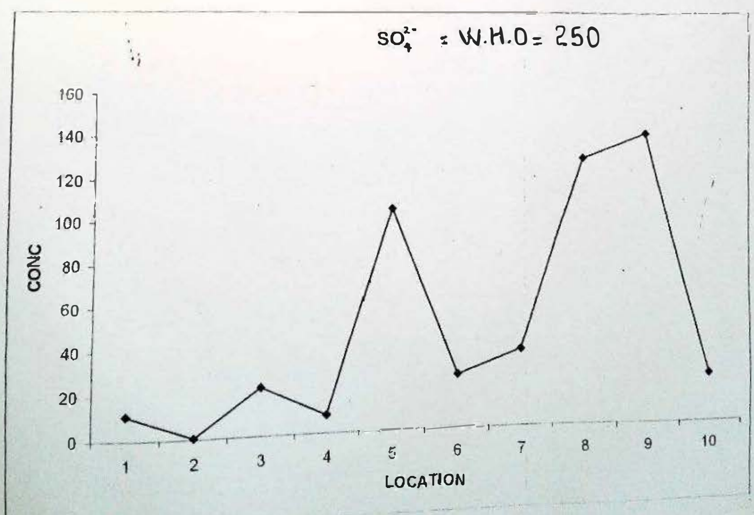
Fig.6

(c)



PO$_4^{3-}$
45
40
35
30
25
20
15
10
5
0
CONC
1
2
3
4
5
6
7
8
9
10
LOCATION
W.H.O

(d)



SO$_4^{2-}$ = W.H.O = 250
160
140
120
100
80
60
40
20
0
CONC
1
2
3
4
5
6
7
8
9
10
LOCATION

(e)

Fig.6

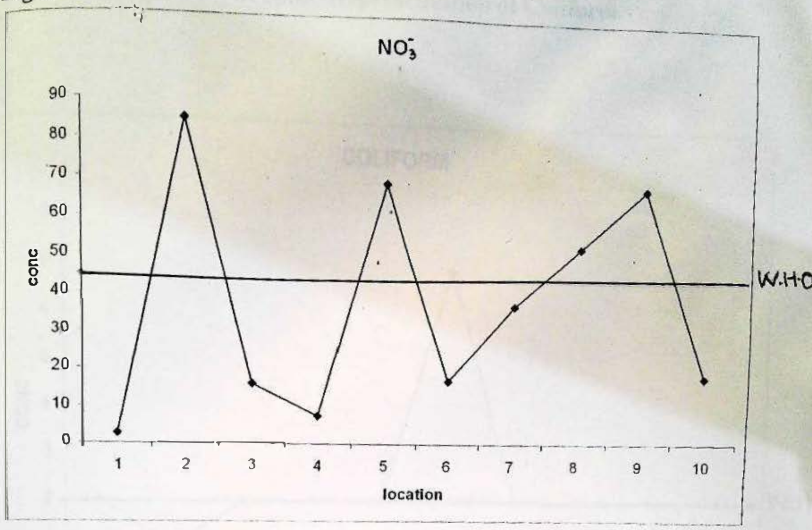
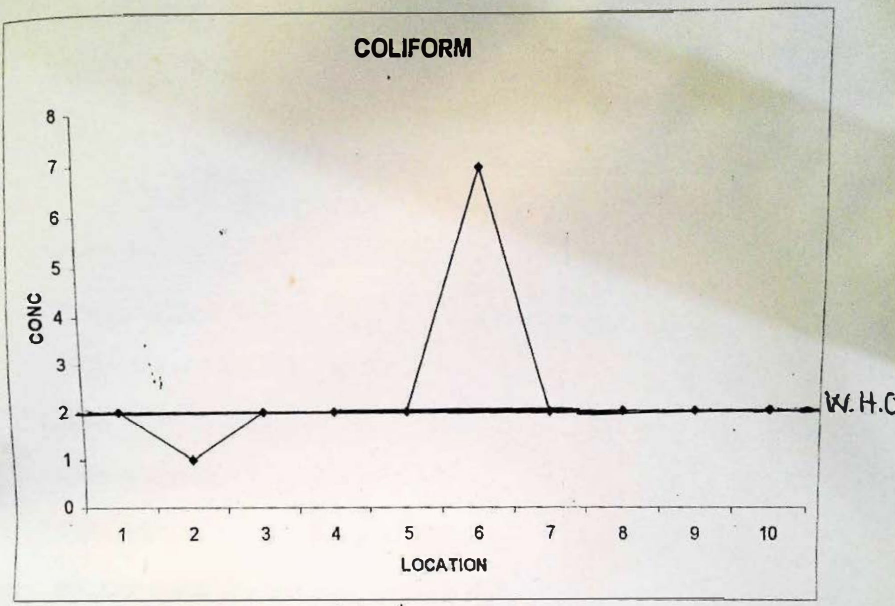


Fig.7 The Graphic Representation of Coliform



CHAPTER FIVE

5.0 DISCUSSION

As stated earlier on, the chemical constituents of ground water commonly reflects the reaction of water with its host rock; this will lead to the released of some chemical elements from the rock; this is also affected by the rate of weathering, ph of water and so on.

The purpose of our work is to determine the safety of ground water for human consumption and agricultural uses. The previous chapter shows the various concentration of the element in the water; this undoubtedly has affect in our organisms if cares not taken when they are in excess or when they lack for our bodies.

Criteria for evaluation water for irrigation

The use of sodium absorption ration (SAR) for classification of irrigation water is expressed as SAR =

(mill equivalent per liter)

$$\frac{Na^{+}}{\sqrt{\frac{Ca^{2+} + Mg^{2+}}{2}}}$$

Table 3: The recommended irrigation water classification based on SAR are:

	SAR	water class
Less than	10	Excellent (No problem)
	10-18	Good (medium)
About	18-26	Poor (High) severe problem

After Offidile 2002

HARD WATER EVALUATION

Water described as "hard" means it is high in dissolved minerals especially calcium and magnesium. Hard water is not a health risk but nuisance because it is tendency to cause mineral build up in water pipe and heating system, and its poor soap and/or detergent performance when compared with soft waters. According to Dissanayake and Chandrajith (1999), they said "one of the most intriguing yet not very well defined aspect is the geochemical correlation between the incidence of cardiovascular disease and the water hardness in some areas".

Table 4: **Hardness of the ground water samples based on Todd, 1980.**

Hardness mg/l caco^3	Water classification	This study of number of well from present work
0-75	Soft	7
75-150	Moderately hard	3
150-300	Hard	
> 300		

The concentration of calcium is within the excessive permissible level. It might originate from the granitic rock. within the study area. The presence of calcium in excess in water is a synonyms to hardness. It is used in the growth of bones in normal conditions. When in excess, it causes formation of piles. When low dietary of Ca is thought to favor the development of fluorosis by enhancing geochemical absorption of fluorine (Crounse *et al* 1983) several studies in Kenya have demonstrated a relation between area with the high incidence of fluorisis and relatively low level of calcium and magnesium in their sources of drinking water.

Magnesium is the numbers of group two elements. It is also an alkaline earth metals and relevant to hard water when it is very high, just like in the case of Tashán Kanjuwa and Anguwan Kasa

(L5 & L9) respectively excessive hard water can cause cardiovascular disease.

Copper is among the heavy metal; such elements are removed by process such as in exchange, precipitation and surface sorption. They are found associated with silica or oxyhyro-oxides. Their concentration in the body causes cancer; it is very high in Rafin Sanye and Anguwa Kasa.

Iron (Fe) belong to the transitional metals in the periodic table. The concentration of iron is high in Rafin Sanyi. Its occurrence can be attributed to the weathering of ferromagnisian mineral of the aquifer and when it is high, it causes clogging of pipe, taste, coloration and deposit and growth of bacteria.

Sodium results from the weathering of plagioclase feldspar.The concentration of sodium in the study area within the permissible level.

Nitrate concentration is high in Rafin Sanyi, Angwan Kasa, Anguwan Marafa and Tashan Ganjuwa. It is attributed to the leaching of fertilizer arrival of waste specially sewage effluent or leaching of nitrate fixed by soil bacteria.

The high concentration causes stomach and oesophageal cancer or methahaemoglobinaemia to infant. **Plate V** show a refuse dump near a well, which could also be a source of high nitrate.

Phosphate concentration is high in Rafin Sanyi ; it could be attributed to the production of traditional alcohol in this location which could affect the water in the shallow well.

Sulphate when found in sufficient quantity causes a bitter taste in water, which may act as a laxative for people not use to drink. However, the amount of sulphate in the study area is low compared to the permissible level.

Chloride content of more than 250mg/l is objectionable for most irrigation or industrial uses; with more than 500mg/l it normally possesses a bad taste. Animal can exceed this as they can thrive well if they drink water that has more than 500 mg/l. Chloride sodium can increase hypertension for elderly human being.

Fluoride concentration is high in Tikken Shanu, Primary school, Ammagala, Tashan Ganjuwa. Fluoride is considered to be an essential element, although dental health problems may arise from an excess of fluoride. The excess of fluoride is harmful.

Table 5: The impact of fluoride on health after W.H.O. 1971.

Concentration	Impact of health
Nil	Limited growth and fertility
0.0-0-.5 mg/l	Dental caries
0.5-1.5 mg/l	Promote dental health
1.5 – 4.0 mg/l	Dental fluoride/mottling of teeth
4.0 – 10 mg/l	Dental fluorides; skeletal fluorides
> 10 mg/l	Crippling fluorosis

One of the origin of fluorides in the surface and ground water is the leaching of the rock rich in fluorine eg. Granite 750 ppm; Alkali rock 950 ppm ; phosphate fertilizer 3.0 - 3.5%. A conference held in Beijing China revealed that out of the population of 100 millions, 43 millions people with dental fluorosis while 2.3 millions suffer from skeletal fluorosis.

Bacteriological analyses show a high present of organism in Sabon kaura. This might be due to the same level of well with the ground (plate 2) i.e. some bacterial from near by refuse can drop in it, and consequently high bacteria content. During the rainy season it is obvious that these results could increase. This is generally treated by boiling the water or adding some chlorine.

Conductivity is the measure of the amount of ion in water sample, it also depend on the temperature of ground water; decrease in temperature also increase the mobility of ion thereby increase in conductivity. The result shows a high value of conductivity.

Total dissolved solid is the sum of concentration of all dissolved solid chemicals in water. The result shows the high value in Anguwa Kasa, Anguwa Marafa, Tashan Ganjuwa ; these impurities can be attributed to the impurities from the environment or from the weathering of the host rock.

Table 6: **Shows the water related diseases in Soro as revealed by Dispensary.**

Diseases	2002	2003
Dysentery	450	948
Diarrhea	684	204
Schistosomiasis	3	4

The dispensary is just four (4) years old and it does not have laboratory to check other water related disease.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

The chemical, physical and bacteriological analyses carried out in the research area showed an anxious result.

Physical analyses showed a high .level of conductivity and total dissolved solid in almost all the sampled location.

The chemical analyses, we observed that some element are very high example is the high concentration of copper in Anguwan Kasa. The variation is shown in the previous graph.

Bacteriological analyses gave a very high presence of organism in Sabon Kaura

It become obvious that population of Soro Town Ganjuwa L.G.A. is suffering from water scarcity and water related diseases as confirmed by the data obtained from the dispensary. On that note, I wish to recommend the following.

1. The government should repair and fix their water tank of the town, because apart from the dispensary that the nurses are using hand pump well all others are using open well which is not raised above the ground. As shown by **plate vi**
2. Effort should therefore be made to establish and enforce a safe well to latrine distance standard (10m) for the new

Plate VI Showing Well at the Ground Level

Plate V Showing Dump Refuse near a Well building. According to Yates (1985) septic tanks constitute the largest cause of ground water pollution.

3. A very good well head protection method e.g. the use of raised concrete wall or a properly plastered circular or square concrete wall or a properly plastered circular or square concrete well of considerable height (1m) is suggested.

4. Sealing of abandoned well within the vicinity should be encouraged. Abandoned well are known to constitute a threat to the portability of ground water since this act as a direct channel for contaminants to reach the ground water.

5. Heavy application of fertilizer and pesticides on farms should be discouraged.

6. Indiscriminate dumping of waste should also be discouraged; a central collection Centre of house hold and hazardous waste should established to curtail this habit

7. Define the various hydrological situation which may develop or accelerate pollution process

8. Evaluate the infiltration potential waste on land surface

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