

ACTIVITY REPORT HYDROLOGY GROUP

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January 19, 2013 Ngongzang Stream

Introduction

In order to achieve overall objective of the hydrology group that was set within the SATREPS - Cameroon Projects, whose general topic is “Magmatic Fluid Supply into Lakes Nyos and Monoun and Mitigation of Natural Disasters through Capacity Building in Cameroon”, an investigation campaign was carried out in the vicinity of the Lake Nyos. The specific objectives of the field work were the following 3 points:

- 1) Sampling of selected springs/streams in and around the Lake Nyos hydrological catchment
- 2) Set up a temporal rain water collection system for subsequent establishment of a local meteoric water line.
- 3) Set up a continuous conductivity, temperature, and depth (CTD) sensor on the bed of one of the flowing springs.

Methodology of the field work and installation of the field facilities

1) Water sampling and analytical method on site

A sampling campaign was conducted from the 18th to the 20th of January 2013. During the survey, 20 water samples were collected from 17 sites as shown in Fig. 1. Field parameters, including electrical conductivity (EC), water and atmospheric temperatures, pH, oxidation- reduction potential (ORP) were measured at each sample site using portable analyzing kits. The geographical position of the sampling points was recorded by a handheld GPS device. For alkalinity measurements, some were done directly on the field and the others, in the night time of the same day. The water samples were properly collected after the field parameters had stabilized and preserved in polyethylene bottles for subsequent analyses of major ions, stable environmental isotopes, and trace elements. For determination of dissolved ferrous iron (Fe^{2+}), 2,2'-bipyridyl was added into the water samples on-site to prevent the atmospheric oxidation. For chlorofluorocarbon (CFC) and sulfur hexafluoride (SF_6) measurements, groundwaters from sites No. 9 and No. 7 were collected in 100 ml and 500 ml glass bottles, respectively. Figure 2 shows on-site measurement alkalinity and sampling.

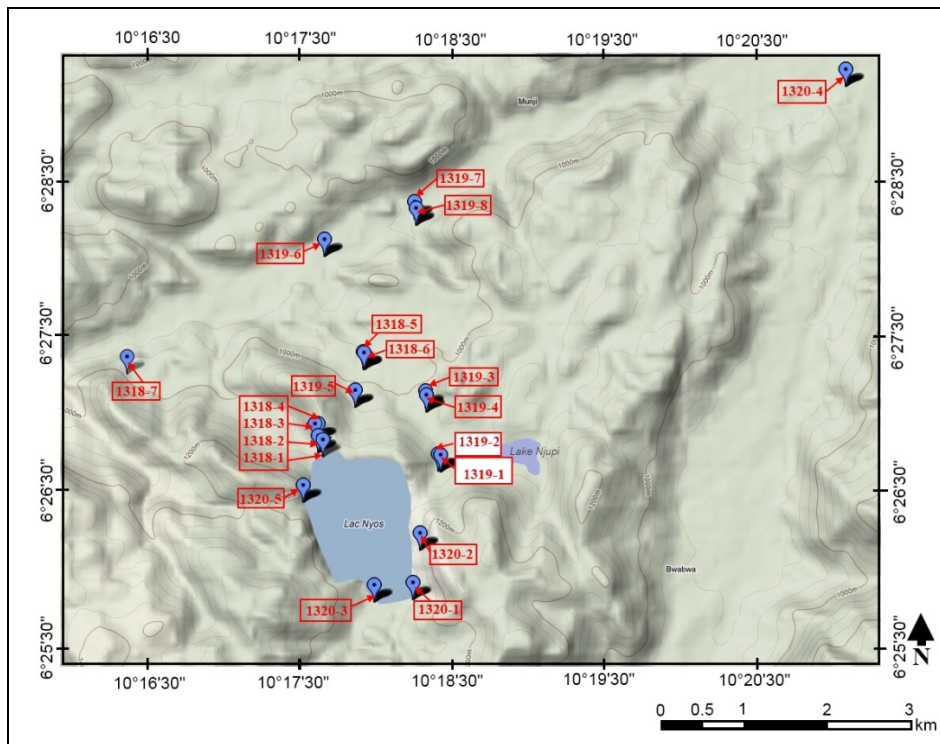


Fig.1 Sampling points



Fig. 2 In-situ measurements of alkalinity and sampling

2) Installation of rainwater collector

Two sets of rainwater collection system were installed at Nyos village. One of the systems had a 5 liter collector, which is to be sampled monthly, and another system had a 250 ml collector, which is to be sampled weekly. The rainwater collection system is meant for continuous long term sampling for subsequent water isotope analyses, whose data shall be used to establish a local meteoric water line for Nyos and its environs. Mr. Ousman of Nyos village was trained and designated for the temporal collection (Fig. 3).



Fig. 3 Installation of rainwater collector

3) Installation of CTD diver sensor

A CTD sensor (Fig.4), was installed on the bed of the spring named “End of lava flow A” at the site (N 6.27168: E 10.17554) to record changes in electrical conductivity, temperature, and depth of water with time.



Fig. 4 A CTD diver that was placed on the spring bed

Preliminary results of the field measurements

The results of field measurements are given in Table 1.

1) Temperature

Figure 5 shows the spatial distribution of the water temperatures of all the sample points. Temperature is a parameter depending on many factors such as altitude of the site, sampling time and weather. Its value ranged from 16 to 23.8°C with a mean of 20.4°C. On the whole, this average value (20.4°C) is close to that obtained during December 2011 sampling (20.7°C). Soda spring (B) shows the highest values of temperature (23.8°C).

2) pH

The pH of the collected samples is ranging from 5.35 to 8.28 with a mean of 7.14 close to the neutral. The spatial distribution of this parameter is given in Figure 6

3) Oxidation- Reduction Potential (ORP) and Fe²⁺

The ORP values ranged from 16 to 23.8°C and -8 to 260 mV. East Nyos cliff Spring show the lowest value (-8 mV) while Soda Spring A shows the highest value (260mV). Ferrous iron (Fe²⁺) concentration of all samples is less than 10 ppm. The highest value is that of Soda spring B (around 5 ppm, however this needs verification).

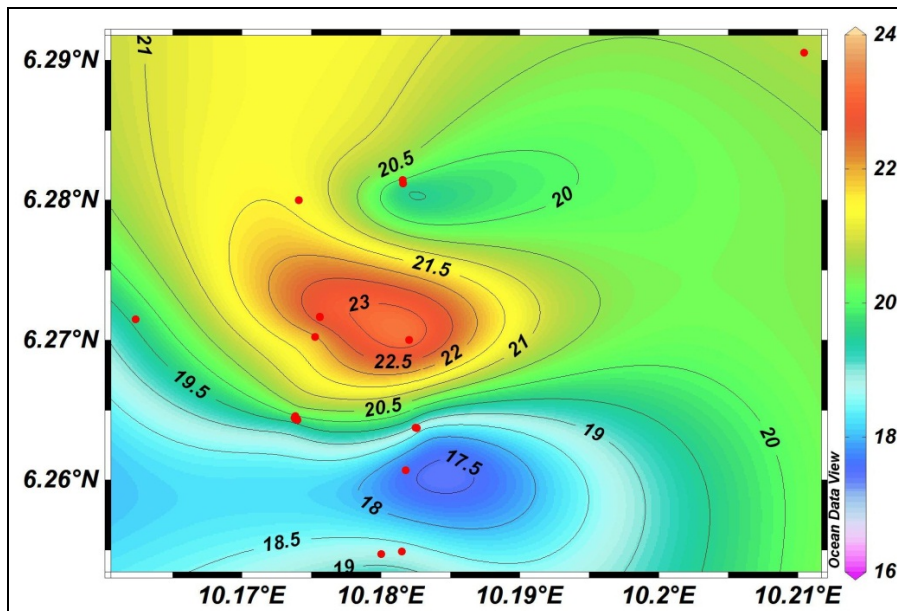


Fig. 5 Spatial variation of water temperature

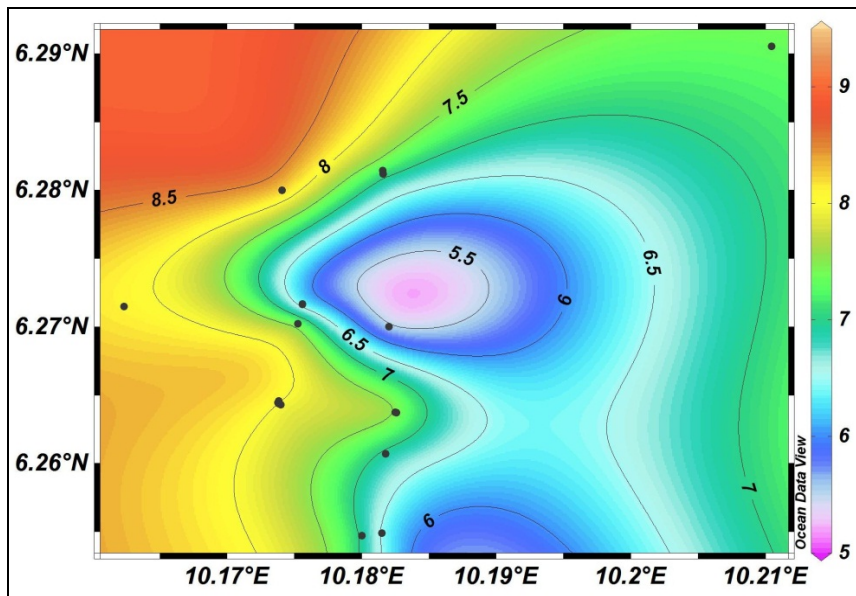


Fig. 6 Spatial variation of pH value

4) Electrical conductivity (EC)

Figure 7 shows the spatial distribution of the EC of all the samples collected. The values ranged from 1.83 to 53.6 mS/m with a mean of 15.5 mS/m. The samples collected in the recharge area of the lake, which are the new sampling points in this field work, show the lowest (Atchap Nyos Spring, Alberto Spring and Lake recharge river) values while the Soda Spring (B) shows the highest value (Table 1).

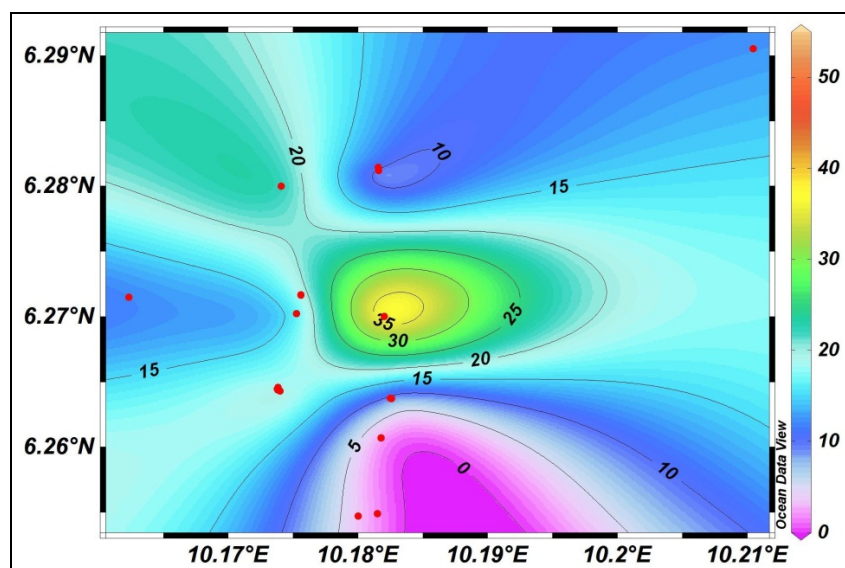


Fig. 7 Spatial variation of EC value

Preliminary conclusion

The dam escarpment springs, end of lava flow springs, Alieu spring, Fukum spring, Ngonzang stream, Soo'she stream, Nkwatsung stream, and Lava basement contact 2 stream are located in the downstream side of the Lake Nyos. The EC values of those samples are higher than 10 mS/m, which are higher than that of other waters except Soda Springs. Those waters may be hydrochemically related with the water of Lake Nyos.

Koim spring, Achaf spring, and Alberto spring, and the Njupi outlet stream are located in the upper stream side of Lake Nyos or the out of the watershed of Lake Nyos, and the EC value of those samples is less than 6 mS/m.

The soda springs (Fulani springs) constitute another independent hydrochemical system.

Table 1: Field measurements of water samples during hydrological survey at Lake Nyos (Jan 2013).

Sample names	notification	Latitude	Longitude	Altitude (m)	T°C (Atm)	T°C (sample)	pH	c25°C (mS/m)	ORP (mV)
Nyos surface	1318-1	6.26431	10.17397	1106	22,8	20,2	7,8	20,20	213
Nyos cliff Sp 1	1318-2	6.26441	10.1738	1072	22,6	17,7	8,09	19,43	149
Nyos cliff Sp 2	1318-3	6.26446	10.17376	1163	25,7	20,2	8,03	19,85	189
East Nyos cliff Sp.	1318-4	6.26459	10.17383	1083	27,9	21,2	8,07	16,23	-8
End of Lava flow (a)	1318-5	6.27167	10.17557	978	23	22,6	6,36	22,60	117
End of Lava flow (b)	1318-6	6.27166	10.17557	978	23	22,9	6,27	14,85	257
Alieu Stream	1318-7	6.26366	10.18357	-	19	19,6	8,09	11,99	209
Koim Stream	1319-1	6.26372	10.18258	1037	19	16	6,83	2,18	228
So'oseh Stream	1319-2	6.26375	10.18248	1036	25,4	21,6	8,13	15,60	220
Soda Spring A	1319-3	6.27001	10.18202	1014	25,6	23,8	5,35	19,84	260
Soda Spring B	1319-4	6.27002	10.18202	1013	25,5	22,6	5,72	53,60	73
Fukum Spring	1319-5	6.27023	10.17524	1055	24,1	21,8	7,52	15,76	219
Ngongzang River	1319-6	6.28001	10.17405	892	25,4	21,4	8,28	22,50	211
Nkwatsung River	1319-7	6.28145	10.18155	882	21,8	21,1	7,41	14,57	183
Njupi out flow	1319-8	6.28122	10.18159	883	20,9	18,6	6,92	5,10	113
Atchaf Nyos Sp.	1320-1	6.25492	10.18148	1103	26,8	18,7	6,4	1,83	132
Alberto Sp.	1320-2	6.2607	10.18177	1149	26,6	17,6	6,89	2,32	209
Lake recharge River	1320-3	6.25474	10.18	1109	30,6	18,8	7	3,44	59
Lava base contact River	1320-4	6.29054	10.21044	824	28,6	20,7	7,33	12,46	82
Drinking water Sp.	1320-5	6.26254	10.17322	1120	-	-	-	-	-