

# ACTIVITY REPORT HYDROLOGY GROUP

16<sup>th</sup> – 23<sup>th</sup> January 2013

By

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## **Team Members**

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## **Introduction**

In the collective goal to achieve the objectives of the SATREPS - Cameroon Projects whose the general topic is “Magmatic Fluid Supply into Lakes Nyos and Monoun and Mitigation of Natural Disasters through Capacity Building in Cameroon”, the Hydrology group has conducted an investigation campaign at Nyos within the framework of the monitoring of water resources of the lake and its surroundings.

### **● Water sampling and analytical method on site**

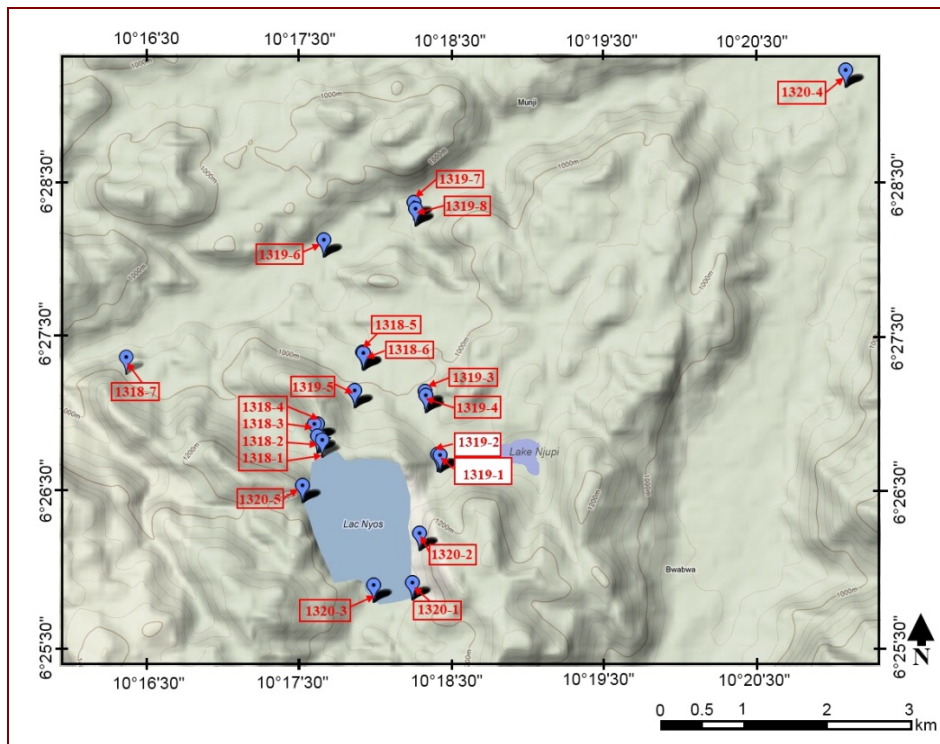
A sampling campaign was conducted from the 16th to the 23th of January 2013. During the survey, 20 water samples were collected from 17 sites as shown in Fig. 1. Field parameters, including electrical conductivity (EC), water and atmospheric temperatures, pH, oxidation-reduction potential (ORP), Fe<sup>2+</sup> were measured at each sample site using handheld analyzing kits, and its GPS position noted. 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 chlorofluorocarbon (CFC) and sulfur hexafluoride (SF<sub>6</sub>) measurements, groundwaters from 9 and 7 sites respectively were collected in 100 ml and 500 ml glass bottles properly. Fig. 2 shows on-site measurement alkalinity and sampling. In addition, two sets of rainwater sampling and one CTD diver sensor were installed at Nyos village. The CTD sensor was installed on the bed of the spring named “End of lava flow A” in order to observe variation in electrical conductivity, temperature and depth function of time.

### **● Preliminary results and interpretations**

The results of field measurements are given in Table 1.

#### **➤ Temperature**

Figure 3 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 20.37°C. On the whole, this average value (20.37°C) is close to that obtained during December 2011 sampling (20.72°C). Soda spring (B) shows the highest values of temperature (23.8°C).



**Fig.1** Sample collection points



**Fig. 2:** In-situ measurements of alkalinity and sampling

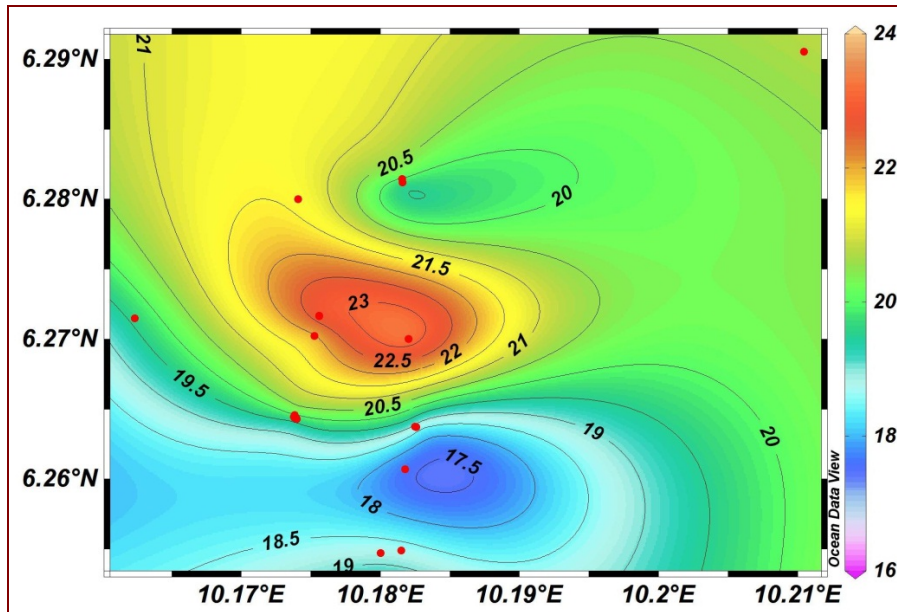
➤ **pH**

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 4

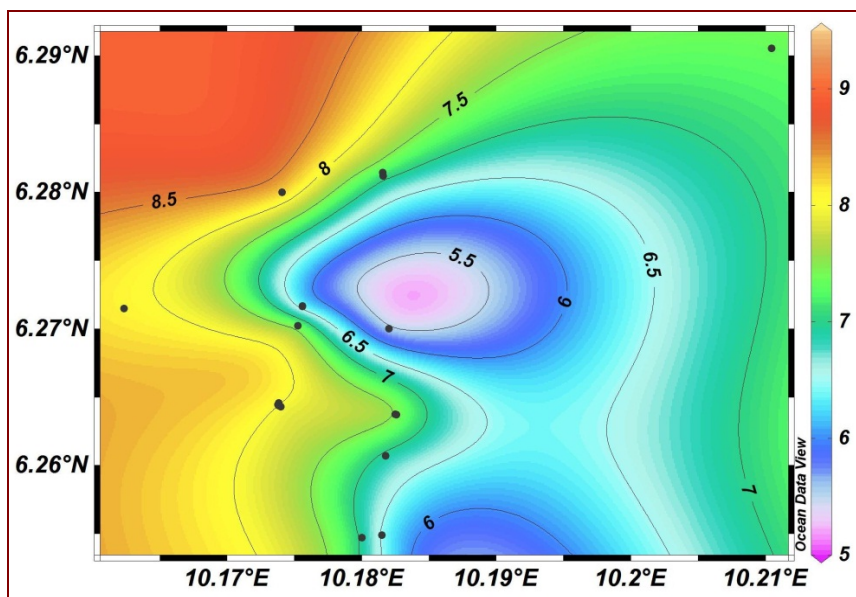
➤ **Oxidation- Reduction Potential (ORP) and Fe<sup>2+</sup>**

The ORP values ranged from 16 to 23.8°C and -8 to 260 mV. Est Nyos cliff Spring show the lowest value (-8 mV) while Soda Spring A shows the highest value (260mV). Fe<sup>2+</sup> 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. 3:** Spatial variation of water temperature

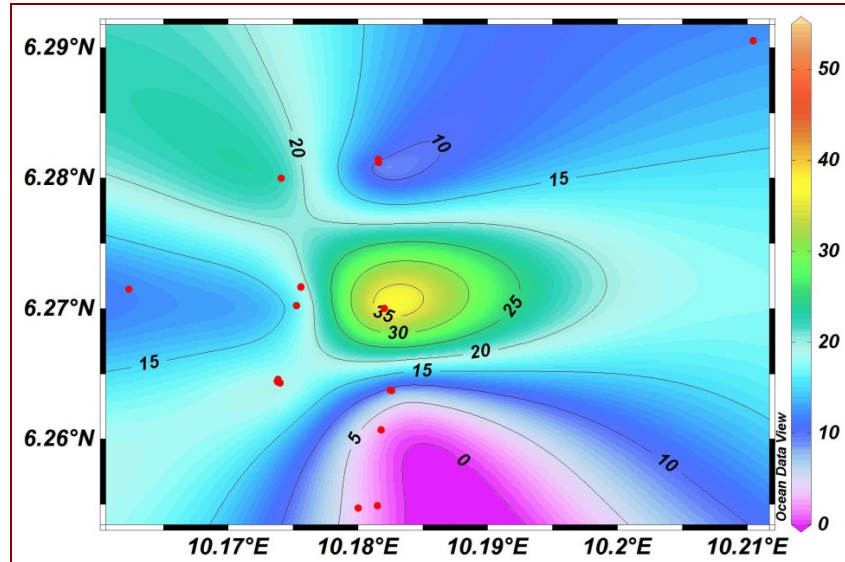


**Fig. 4:** Spatial variation of pH value

➤ **Electrical conductivity (EC)**

Figure 5 shows the spatial distribution of the EC of all the samples collected. The values ranged from 1.83 to 53.60 mS/m with a mean of 15.46 mS/m. Therefore samples collected in the recharge area of lake and consider as the new finding of the January 2013 sampling campaign show the lowest (Atchap Nyos Spring, Alberto Spring and

Lake recharge river) shows values while the Soda Spring (B) shows the highest value. Table 1.



**Fig. 5:** Spatial variation of EC value

### ● Preliminary conclusion

Based on the field measurement, there is a slight variability between these values and those obtained during the December 2011 sampling campaign. The pH value for both sampling campaign is close to neutral (7.14 and 6.41 respectively for January 2013 and December 2011 sampling campaign).

The EC values of waters in all the investigate catchment are mostly lower than those of the lake. The highest value of this parameter and which constitute the main discovery of this sampling campaign is that of the Soda spring (B) (56.60 mS/m). The physical characteristics of this Soda spring differs from all the others and especially from that of Soda spring (A) located of about 5 m to the north-western. These results suggest that the drains that lead these Soda springs to the surface are distincts and may not have relation with lake waters. At the emergence of Soda spring (A), more than twelve dead birds were counted. (Fig. 6). The position of these dead birds on the site may suggest two probable assumptions. At first, a certain amount of gaz was released in the atmosphere suddenly trapping birds which were perched on a branch above the source, or in the second hand, these birds have drunk the water of this Soda spring which may be very toxic. Therefore a special attention should be given to these Soda springs.

The chemical reactions occurring in the lake, the nature of the rocks (consolidated

basement and unconsolidated pyroclastic materials) in the basin and the transit time may be the main parameters controlling the mineralization processes of water within the basin.



**Fig. 6:** Dead birds at the emergence of Soda spring A

**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
Est 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
Aliou 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	-	-	-	-	-