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Soil and atmospheric controls on the δ^{13}C of riverine dissolved inorganic carbon in the Nyong river basin (South Cameroon)

G.R. Nkoue Ndondo (1,2,3), F. Brunet (1,4), J.L. Probst (3), J.L. Boeglin (1), J.R. Ndam Ngoupayou (2), G.E. Ekodeck (2), F. Gauthier-Lafaye (3), and J. Mortatti (6)

(1) LMTG, UMR 5563 CNRS-IRD-UPS, 14 avenue Edouard-Belin, 31400 Toulouse, France, (2) Department of Earth Sciences, Université de Yaoundé I, BP 512, Yaoundé, Cameroun, (3) ENSAT-INP, ECOLAB, UMR CNRS-INP-UPS, Av. de l'Agrobiopole, 31326 Castanet Tolosan Cedex, France, (4) Ottawa-Carleton Geosciences Centre, University of Ottawa, 140 Louis Pasteur, Ottawa, ON10 K1N 6N5, Canada, (5) Centre de Géochimie de la Surface, EOST, CNRS/ULP, 1 rue Blessig, 67084 Strasbourg Cedex, France, (6) Centro de Energia Nuclear na Agricultura USP, Av. Centenário, 303 Caixa Postal 96 13400-970 Piracicaba, SP Brésil

(raoulnkoue@yahoo.fr / Fax: (33) 5 61 33 25 60 / Phone : (33) 5 61 33 26 26)

The riverine flux of dissolved inorganic carbon (DIC) in granitic forested catchments mainly originates from the atmospheric CO_2due to the following three biogeochemical processes:

1- DIC can be generated from the carbonic acid used in the hydrolysis reactions of the silicate minerals during natural weathering pathway. This carbonic acid is produced in the soil solution by the mineralization of litter and soil organic matter, which releases CO_2. Consequently, in such a case, one can say that DIC exclusively originates from the atmospheric CO_2, due to the biomass production and the soil organic matter oxidation.

2- DIC can originate directly from the oxidation of riverine organic carbon (dissolved and particulate), which then releases dissolved CO_2 in the river water.

3- atmospheric CO_2can be also directly transferred from the atmosphere into the groundwater and to the river as dissolved CO_2, when temperature and partial pres-

sure of CO_2 (pCO_2) allow it.

In the Nyong river basin located in the equatorial humid forest of the South Cameroon, the intensity of these different processes vary according to the hydrological conditions and they are highly affected by the climatic seasonality. At the scale of the upstream catchments (Mengong, Awout and So'o), during the rainy seasons (March – May and September – November), stream waters are mainly supplied by the drainage of rich organic carbon swampy areas. Negative $\delta^{13}C_{DIC}$values (-23.5‰ on average) are associated with high riverine DOC content. During this period, $\delta^{13}C_{DIC}$is mainly controlled by the oxidation of organic carbon. In contrast, during the dry seasons (June – September and January – March) when swampy areas shrink, it is observed that stream waters come mainly from the deep groundwaters, which have a very low organic carbon content. So, relatively higher values of $\delta^{13}C_{DIC}$are measured (-18‰ on average) and are controlled by the degassing of soil CO_2 in the swampy areas, and to a lesser degree by the diffusion of atmospheric CO_2 into the soil in the hill slopes. In the main channel of the Nyong (Mbalmayo and Olama stations), $\delta^{13}C_{DIC}$range from -22.1‰ during the rainy seasons to –7.4‰ during the dry seasons. The lowest values are the result of riverine CO_2 degassing towards the atmosphere and the highest values are due to the riverine CO_2 produced by organic matter oxidation. These observations are confirmed by the relationship between the $\delta^{13}C_{DIC}$and pCO_2 in the river. The more negative $\delta^{13}C_{DIC}$values correlate to the higher pCO_2values.