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Paleoclimatic and deforestation effect on the chemical and isotopic composition of the coastal fresh groundwater resources of South-east Ivory Coast

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Since a half of century, the forest surface area of the South Ivory Coast has been decreased for the benefit of agriculture (15 000 km2 in 1993 versus 83 000 km2 in 1955-1958). This area also undergoes climate change. Vegetation cover has gradually changed from rainforests (C3 plants) to savanna (C4 plants) and agricultural plants. In the Abidjan area (5.00-6.00°N, 2.40-4.40°W), the mean rainfall amount and temperature value evolve during the 20th century (1912 mm/year and 26.3°C/year during the first decennial to 1613 mm/year and 26.9°C/year during the last ten years). The Paleoproterozoïc fractured bedrock (PB) and the Continental Terminal (CT) deposits groundwater are studied to show the climate change and deforestation effect on the area groundwater resources using stable isotopes (18O, 2H and 13C) contents, radiocarbon (14C) contents and chemical data on a set of 25 groundwater samples. The residence time of the groundwaters is estimated by the 14C using two models: (i) the model of well-mixed reservoir (WMR model) and (ii) the piston flow model (PF model). The range of the PB groundwater residence time (15 000 – 8 000 to $\tilde{3}$00 – 100 a BP) for both models shows that the recharge has started at the beginning of the post-glacial period whereas the CT aquifer recharge is much more recent (from 300 a BP to today). The PB groundwater provides information about paleoclimatic conditions that occurred over the studied area during the late Pleistocene. It is demonstrated, through this study, that the evolution of vegetation cover (from forests to savanna and agriculture plants) is shown in groundwater by the trend in 13C content from old groundwater (confined bedrock groundwater: residence time of $\tilde{1}$5 000 a BP) to the recent groundwater (unconfined bedrock groundwater and CT groundwater: residence times: $\tilde{3}$00 a BP and lower than 100 a BP, respectively). The 18O and 2H values also increase with time from the beginning of the post-glacial period ($\tilde{1}$5 000 a BP) to the present day (< 100 a BP), showing the evolution of the climate from cold to warm conditions. This study has shown the paleoclimate effect on the water resources in Ivory Coast and are consistent with the results obtained by some authors in Western Africa (Ghana, Liberia, Mali and Niger).