

Petrogenetic processes generating magma beneath the Nyos maar volcano (Cameroon Volcanic Line, West Africa): field relation and geochemical characterization of volcanic rocks

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The Nyos volcano is one of the four strato-volcanoes that make up the Oku Volcanic Group (OKVG) along the Cameroon volcanic Line (CVL). At an altitude greater than 1,000 m, the volcano hosts a 210 m - deep maar lake rich in CO₂ gas. Sudden release of CO₂ in 1986 from the maar lake resulted in the death of over 1,700 people and more than 3,000 cattle. A process of artificially removing the accumulated gas from the lake is currently underway. Previous studies of this catastrophic event have only focused on the nature and mechanisms of migration and accumulation of CO₂ in the lake, and have concluded that the CO₂ in Lake Nyos comes from the mantle. This finding raises the fundamental question as to why the Lake Nyos mantle is highly rich in CO₂. This research is aimed at addressing this question by using trace elements and radiogenic (Sr-Nd-Pb-Os) isotope systematics in lavas to probe the mantle beneath Lake Nyos and other volcanoes of the OKVG for mantle petrogenetic processes producing the magmas. In the preliminary analysis of 8 volcanic rocks from the Nyos area, 7 samples present K₂O/Na₂O ratios ranging from 0.15 - 0.56 (SiO₂ = 35.5 - 465.6 weight percent; Mg number = 47.7 - 66.3; Sr = 768 - 1011.7 ppm; Pb = 1.47 - 3.36 ppm), while 1 sample was distinct with K₂O/Na₂O ratio of 1.30 (SiO₂ = 48.6 weight percentage; Mg number = 59.7; Sr = 299.3 ppm, Pb = 21.64 ppm). As for radiogenic isotopes, only four Rb-Sr, two Sm-Nd and one U-Pb isotopic data are currently available in literature for the OKVG samples with MgO >4 weight percent (22 - 23 Ma). In these samples ⁸⁷Sr/⁸⁶Sr ranges from 0.70333 - 0.70380, ¹⁴³Nd/¹⁴⁴Nd from 0.51260 - 0.51283 and ^{206,207,208}Pb/²⁰⁴Pb are 18.77, 15.56 and 38.70, respectively. No Os isotope has yet been measured for this continental volcano. During November and December 2012, we conducted first comprehensive sampling of mafic volcanic rocks from the Nyos volcano and its surroundings. The basement rock of the Nyos area is dissected by tertiary volcanic rocks that overlie them as lava flows and pyroclastic surge. A total of 25 samples were collected. These samples are mafic presenting either aphyric or porphyritic texture with dominant phenocrysts of olivine, pyroxenes and plagioclase. The size of most phenocrysts ranges from 0.5 to 2 mm diameter. Some of these samples are vesicular with some hosting large crustal and peridotite xenoliths.