

Eruption history of Nyos volcano, northwestern Cameroon

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Lake Nyos (2 x 1.2 km), a maar volcano in northwestern Cameroon, exploded a large amount of CO₂ that killed 1746 people 1986. We performed field survey in and around Lake Nyos to establish its eruptive history and formation processes.

Eruptive deposits of Nyos maar lie on Pre-Cambrian granitic basement and can be seen at the north to eastern lakeshore. These include tuff breccia (Unit A-1), scoria fall (A-2), lava flow (A-3) and base surge (A-4), in ascending order. We see no evidence of time breaks between these units as can be typified by paleosol and reworked deposits. A-1 is rich in lithic fragments, such as basaltic bombs with chilled margins (juvenile) and granitic (crustal) and peridotitic (mantle) xenoliths. Its limited areal distribution in the eastern lakeside indicates a nearby vent location (Vent 1). A-2 is clast-supported and mainly composed of well sorted basaltic scoria. The thickness increases from east to north lakeshore. A-3 is deposited 20 m above lake level with covering basement rock and A-2 in the north lakeshore. Its depositional level decreases to the lake level in other parts surrounding the lake. These evidences suggest that the vent that erupted A-2 and -3 was located at the north part of the lake (Vent 2). Distribution of A-3 extends northeastward for more than 10 km along valleys from Lake Nyos. A-4 (most voluminous) is base surge deposits characterized by cross-laminated and fines-poor facies. It consists of dominant basalt, isolated crystals and accidental lithics. The thickness is more than 30 m at the lakeside and it makes a depositional surface 1 km around Vent 2. The distal facies shows well-sorting and parallel laminations containing accretionary lapilli, which can be interpreted as air fall deposits.

A scoria cone is situated 1.5 km northeast of Lake Nyos. Ejecta from the cone (scoria fall) overlies A-4 around the lake, suggesting that activity of the cone started immediately after the Nyos maar-forming event. The cone is not a single cone but a complex structure. The main cone structure is divided into west and east, and the southern slope is collapsed. Several hummocks, which might be debris avalanche deposits from the sector collapse are found at the south to southwestern foot of the main cone. A remarkable crater (NE Vent), cutting part of the main cone is located near the northeast side. Products from the scoria cone consist of scoria fall (B-1), volcanic bombs (B-2) and lava flow (B-3). B-1 is characterized by highly vesiculated basaltic scoria whose thickness and diameter increase towards the main cone. B-2, made of basaltic bombs, was emplaced on B-1 and scattered within about 500 m around the cone. There are two types of bombs: xenolith-poor and -rich. Xenolith-poor bombs are a few meters in size and occur near the main cone and on the hummocks. Xenolith-rich bombs are abundant near the NE vent. This kind of distribution suggests that xenolith-poor bombs were produced from the main cone and xenolith-rich bombs from the NE Vent. B-3 is a small, blocky lava flow less than 500 m long on the southwest side of the main cone.

Existence of accretionary lapilli and chilled margins of juvenile materials in Unit A suggest that phreatomagmatic eruption occurred during the Nyos maar-forming eruption. Although conditions of conduit changed from wet to dry during A-1 to A-3 with shifting of the vent locations (Vent 1 to 2), catastrophic base surge caused by interaction of water and voluminous magma formed Lake Nyos consequently. After that, the locus of eruption moved to the scoria cone. B-1 formed the main part of the scoria cone, and then the cone collapsed to generate debris avalanche deposits on the southern foot. Finally, eruptive activity terminated with small effusion of lava flow from the collapsed cone and formation of NE crater ejecting xenolith-rich bombs. The volcanic activity is characterized by various products and styles of eruptions with changes in vent locations northeastwards.

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