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Effects of the soil-forming factors climate and time on soils of Mount Cameroon (Central Africa)

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Knowledge on rates of soil-forming processes in humid-tropical climate is limited, mainly because objects that are suitable for studying soil chronosequences are rare in tropical regions. Mt. Cameroon, located at the Gulf of Guinea in SW Cameroon, between latitudes 4°00' to 4°20'N, is an ideal object for this purpose. Its volcanic activity started 11 Ma ago and still continues today, providing lava flows of different ages and rather uniform basaltic composition. The climate of the area is humid-tropical, characterised by a distinct gradient in mean annual precipitation (MAP). MAP amounts to > 9000 mm on the SW flank, near the coast, decreasing to < 2000 mm on the opposite flank, in the rain shadow of Mt. Cameroon's peak.

Eight soil profiles, including six on historical lava flows of different ages and two on older (Holocene) lava flows characterised by contrasting MAP, were described and analysed. Soil formation proceeds from Nudilithic Leptosol (on a 13 year-old lava flow) to Skeletic Mollic Leptic Vitric Silandic Andosol (54 years), Umbric Leptic Silandic Andosol (91 and 104 years), and finally to Umbric Silandic Andosol (Holocene, MAP ∼2400 mm) or Umbric Amphisilandic Endoaluandic Andosol (Holocene, MAP ∼8000 mm). The general trends of Fed/Fet and (Ca+Mg+K+Na)/Al molar ratios over time indicate progressive weathering, formation of pedogenic iron oxides, and leaching of Ca, Mg, K and Na. Irregular uppermost parts of the depth curves of these ratios in some soils suggest addition of fresh ash or dust. Organic matter (OM) contents are remarkably high in the 104 year-old soils that are located at ∼3000 m a.s.l., compared to all other analysed soils. A possible explanation is that biomass production and thus OM input are still high at this elevation, whereas the altitudinal temperature decline leads to decreased OM decomposition compared to the lower slope.