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Field evidence for summit subsidence, flank instability and basal spreading at Mt Cameroon volcano, West Africa

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Mt Cameroon is a steep lava-dominated volcano located on the coast of the Gulf of Guinea. This Ĩ400 km3 edifice is one of two active centres in the Cameroon Volcanic Line. Despite recent lava eruptions along its rift zones in 1999 and 2000, little geological or monitoring data are available to understand the structure of this large volcanic system. Here we report results from a field campaign dedicated to mapping geological structures in the summit area and at the SE base of Mount Cameroon. Eruptive fissures and open fractures' orientation, vents' location and alignment above 3500 m a.s.l were systematically surveyed. In addition to the tectonically-controlled N40°E orientation of eruptive fissures along the rift zones, other dominant orientations were identified such as N60°E (summit vents alignment), N20°E and N90° (extension related structures). These were attributed to local instability around the summit, stress field re-orientation around the head of a deep valley cutting through the NW flank and radial pattern around the summit. Inward-dipping structures were also observed to border the relatively flat upper part of the rift zones. Geological profiles were also measured along rivers cutting through a topographic bulge at the SE base of Mt Cameroon. This topographic step was seen to be associated with deformed Miocene sediments from the Douala basin overlain by volcanic products. Weak sediments of this area are deformed by N50-60°E trending asymmetrical folds verging toward the SE and by N10-30°E trending symmetrical folds and thrusts. Initial NE-SW trending structures formed following the sliding of sediments on the flank of a NE-SW elongated uplift dome. Later, the same area has been deformed by NNE-SSW trending compressive structures linked to the spreading of Mt Cameroon southern flank toward the SE. Combined with the interpretation of a 30 m Digital Elevation Models and multispectral satellite data, the field observations suggest that Mt Cameroon is affected by major instabilities. Both slow spreading movements and catastrophic collapses of the steep flanks are interpreted to result from complex interactions between the growing edifice, repeated dyke intrusions, the weak sedimentary substratum and tectonic structures.