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A new volcano-structural map of the Virunga Volcanic Province, D.R.Congo and Rwanda

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The Virunga Volcanic Province (VVP) is situated within the Western branch of the East African Rift system at the boundary of D.R.Congo, Rwanda and Uganda. The Western VVP comprises two active volcanoes, Nyamulagira and Nyiragongo. Six supposedly historically inactive volcanoes are present in the Central and Eastern VVP. Nyamulagira is recently the most active volcano on the African continent, with 30 eruptions since 1900, while Nyiragongo hosts a semi-permanent lava lake in its crater and fed a catastrophic lava flow in 2002. Additionally, numerous volcanic vents, fissures and cones are scattered on and around the main edifices. Except for geological maps from the colonial times and limited studies of historical eruptions, little is known about the volcano-tectonic structure and long term volcanic history of the VVP. A new Digital Elevation Model (TanDEM-X) with a resolution of 5 m, combined with SPOT and SAR images served as a base for the development of a new volcano-structural map for the entire VVP. A GIS data base was developed including the location of eruptive cones and fissures and the distribution of lava flows. The boundaries of historic and pre-historic lava flows and pyroclastic cones were traced from from interpretation of topographic and multispectral remote sensing data and re-analysis of ancient geological maps.Larger-scale lineaments interpreted as potential volcano-tectonic structures were also systematically mapped. All previously geochemically analyzed samples were localized. This GIS-based volcano-structural map will serve as a base for the quantitative characterization of recent and historic volcanic eruption products, such as pyroclastic cones and lava flows, of Nyamulagira and Nyiragongo, as well as for the assessment of potential Holocene activity in the Central and Eastern VVP. The orientation of feeder dykes inferred from cone alignments and morphology is used to identify the main volcanic structures and infer the locally dominant stress field. Geochemistry and eruption characteristics of the 1957 Mugogo eruption to the North of Visoke Volcano, Central Virunga, is used to illustrate the importance of the analysis of historic volcanic activity in the Central and Eastern region of the VVP. The ultimate aim served by the resulting volcano-structural map and data-base is the evaluation of potential future eruption scenarios and the derivation of the spatial distribution of eruption probability.