

Temperal evolution of the St Eustatius Volcanic Field, Lesser Antilles

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The northern part of the Lesser Antilles Arc (LAA) is a complex tectonic region where the volcanic arc migrated 50 km westward since approximately 25 Ma ago. This westward migration has been attributed to the subduction of aseismic ridges, or changes in the relative plate motions between the North American, South American and Caribbean plates. So far it has been unclear, if the changing tectonic conditions modified the timing and geochemical characteristics of these volcanics. Therefore, we determined the ⁴⁰Ar/³⁹Ar ages and Sr-Nd-Pb-Hf isotope composition of all the inactive northern centres of St Eustatius to obtain information from the oldest volcanics of the northern part of the LAA.

The island of St Eustatius can be divided into three parts: (1) the northern centres, (2) The White Wall - Sugar Loaf sedimentary tilted block that also contains volcanoclastics and (3) a young stratovolcano, The Quill. Previous age determinations on the northern centres were unsuccessful, and an age of less than 1 Ma was assumed [1]. Our new ³⁹Ar/⁴⁰Ar data yield an age range of ~1.9-2.1 Ma, indicating a gap of volcanic quiescence of more than 1.7 Myr before volcanism resumed. The northern centres are composed of an alternation of pyroclastic rocks, lava flows and domes with a low-K basaltic-andesite to andesite composition (SiO₂=53-63 wt.%).

The Sr-Nd-Pb-Hf isotopes of the northern centres overlap mostly with volcanics of St Martin and Saba, and not with those of the present-day Quill volcanics. We attribute these differences in isotopes and trace-element characteristics of the northern centres to a larger degree (~5%) of assimilation of hydrothermally altered arc crust. The geochemical resemblance of volcanics of St. Martin, the northern centres of St Eustatius and Saba suggests no significant temporal changes in the subducted components or mantle wedge over a period of more than 30 Ma.

[1] Roobol and Smith (2004) *KNAW*, Amsterdam, the Netherlands