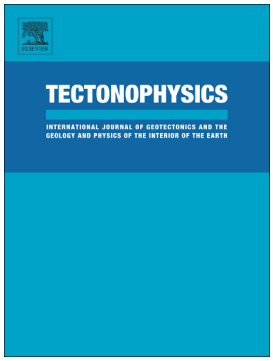

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Marie Chaput, Vincent Famin, Laurent Michon

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Sheet intrusions and deformation of Piton des Neiges, and their implication for the volcano-tectonics of La Réunion

Marie Chaput[1, 2], Vincent Famin[1], and Laurent Michon[1]

[1] Laboratoire GéoSciences Réunion, Université de La Réunion, Institut de Physique du Globe de Paris, Sorbonne Paris Cité, UMR 7154 CNRS, F-97744 Saint Denis, France.

[2] Bureau d'études Stratagem974, 62 Boulevard du Chaudron, 97490 Sainte-Clotilde, La Réunion, France.

Highlights

- Perpendicular intrusion trends in a basaltic volcano, two rift zones and two sill zones.
- Extension dominates the internal stress state of Piton des Neiges.
- Volcano-tectonics mainly consists in brittle deformation and sheet intrusions.

Abstract

To understand the volcano-tectonic history of Piton des Neiges (the dormant volcano of La Réunion), we measured in the field the orientation of sheeted intrusions and deformation structures, and interpreted the two datasets separately with a paleostress inversion. Results show that the multiple proposed rift zones may be simplified into three trends: 1°) a N030°E, 5 km wide linear rift zone running to the south of the edifice, active in the shield building (≥ 2.48 - 0.43 Ma) and terminal stages (190 - 22 ka); 2°) a curved N110 to N160°E rift zone, widening from 5 km to 10 km toward the NW flank, essentially active during the early emerged shield building (≥ 1.3 Ma); and 3°) two sill zones, ≤ 1 km thick in total, in the most internal parts of the volcano, active in the shield building and terminal stages.

In parallel, deformation structures reveal that the tectonics of the edifice consisted in three end-member stress regimes sharing common stress axes: 1°) NW-SE extension affecting in priority the south of the edifice near the N030°E rift zone; 2°) NNE-SSW extension on the northern half of the volcano near the N110-160°E rift zone; 3°) compression occurring near the sill zones, with a NE-SW or NW-SE maximum principal stress. These three stress regimes are spatially correlated and mechanically compatible with the injection trends.

Combined together, our data show that the emerged Piton des Neiges underwent sector spreading delimited by perpendicular rift zones, as observed on Piton de la Fournaise (the active volcano of La Réunion). Analogue experiments attribute such sector spreading to brittle edifices built on a weaker