Geophysical Research Abstracts
Vol. 12, EGU2010-4320, 2010
EGU General Assembly 2010

Architecture and evolution of La Réunion inferred from geophysical data

Lydie Gailler and Jean-Francois Lénat
Universite Blaise Pascal, CNRS, Clermont-Ferrand, France J.F.Lenat@opgc.univ-bpclermont.fr,)

Architecture and evolution of La Réunion inferred from geophysical data
Lydie Gailler and Jean-François Lénat
Laboratoire Magmas et Volcans, Université Blaise Pascal, CNRS, Clermont-Ferrand, France

The Island of La Réunion, the Indian Ocean, is a large, mostly immerged, oceanic volcanic system. We present a study of its internal structure using geophysical methods. Subaerial and marine gravity and magnetic measurements has been compiled along with terrestrial-based electromagnetic surveys. The ensemble of data has been used to construct gravity, magnetic, and electromagnetic models, which are based on geological constraints and previous geophysical interpretations. We are able to differentiate structures from before and after the Brunhes-Matuyama magnetic inversion using the magnetic measurements according to the polarity of the anomalies. The gravity measurements allow us to detect and characterize the dense intrusive complexes and to complement the magnetic measurements in regard of the nature of the coastal formations and submarine flanks. The electromagnetic surveys allow us to determine the distribution of electrical resistivities which we interpret in terms of saturation of rocks with water, hydrothermal alteration and the presence of mineral hydrates, or complexes of phaneritic or microphaneritics rocks. The integration of the geophysical results allows us to build up a large scale model of the volcanic system.
At the scale of the Piton de La Fournaise we distinguish both shallow and deep sources. The shallow ones correspond to the filling of ancient depressions by dense lavas flows, to the Central Cone which is largely constituted of scoria, or to the level of breccias at the base of the large valleys to the south. The deep structures are associated with the intrusive complexes from the Alizés volcano and from the Ancient Shield of the Piton de la Fournaise. The analysis of magnetic anomalies demonstrates a very shallow layer of products from Piton de la Fournaise on its northern and eastern flanks. It also indicates the presence of a body of weakly magnetized rocks underneath the central zone, correlated with the presence of a hydrothermal system which is well characterized by a dome of rocks of low resistivity and magma storage structures. Beneath the Ancient Shield, a region of weak resistivity may correspond with an ancient hydrothermal system. The Piton des Neiges is shown as an immense volcano structured around a hypovolcanic system which extends a great distance laterally and vertically. The coverage of the Brunhes formations is incomplete and gives variable thicknesses. Only the western flank, the summit zone and, to a lesser degree the northern flank, present significant thicknesses of these products. Topographical barriers, such as the regions of collapse or landslides could explain the discontinuous distribution of these formations at the scale of the massif. There is an obvious correlation between the lateral spreading of the dense body and the topographical depressions above, suggesting a relationship between the subsidence of the intrusive complex and that of the depressions.
At the scale of the immerged system the morphology of two large zones of ancient volcanic constructions is reconstructed to the east of the Piton de la Fournaise and to the south-west of Piton des Neiges. These results bring to question the interpretations of seismic data in these particular sectors. The morphology of the emerged-immerged edifice can be reconstructed. At the land-sea transition, the coastal shelf is interpreted in terms of accumulation of hyaloclastites and pillow-lavas. On the immerged flanks, our analysis confirms that the four submarine bulges are due to the accumulation of avalanches debris deposits of which the internal density contrasts can be correlated with specific geological units observed from the surface.