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30 years of scientific research at Karthala volcano (Grande Comore – Indian Ocean)

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Karthala is a large basaltic shield volcano forming about two-thirds of the Grande Comore Island in the western Indian Ocean. It is characterized by a typical "Hawaiian" shape with two well-developed rift zones diverging from a polylobate 4 x 3 km summit caldera complex. Karthala is non-dissected by erosion, but the concave morphology of its southern and eastern flanks may have resulted from huge flank landslides.
Karthala volcano is one of the most active African volcanoes. During the last two centuries, most of the eruptions were magmatic, emitting alkali basalts. They were characterised by eruptive fissures opened along the rift zones (as in 1857, 1858, 1859, 1860, 1862, 1872, 1882, 1904 and 1918), within the caldera (1948,1952,1965,1972), or at low elevation far from rift zones and the caldera, as in 1977 (Bachelery and Coudray, 1993). Karthala's eruptive style is mostly effusive, however, phreatic and phreatomagmatic explosions also occur (eg 1918, 1948, 1952, 1991). Karthala has erupted about every 12 years over the past 100 years until the phreatic eruption in 1991. Since then, its activity has increased until the paroxysms of 2005 to 2007, with four major eruptions with significant impacts on local populations. The two violent strombolian eruptions in 2005 were more explosive and longer than the preceding eruptions, projecting ashes and volcanic debris on the eastern part of the island, affecting as many as 118,000 people. In the recent past, the 1977 eruption was the most destructive of Karthala's historic lava flows. But in 1858, a lava flow travelled 13 km from the uphill north rift zone to the western coast, going close to the capital Moroni. Whatever the location of the eruptive vent, lava flows can reach inhabited areas and the sea in a few hours.
Since the last 30 years, many works concerning volcanology, structural geology, petrology, geochemistry and geophysics have been done by our group on this scientifically attractive volcano. We propose a synthesis of the current knowledge about this typical shield volcano, which however differs in many ways from the Hawaiian hotspot volcano model.