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Geological and petrological aspects of the ongoing submarine eruption at El Hierro Island (Canary Islands, Spain)

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The Canarian Archipelago comprises seven major and three minor islands, all of them of volcanic origin. The distribution of the islands forms an east–west volcanic chain, starting about 90 km west of the northwest African continental margin. The canary volcanism is unique among ocean islands (long lifetime, multiple periods of volcanic activity, extensive range of magma compositions) and various theories were developed in order to explain that specific volcanism, with such a variety of volcanic phases and chemical diversity.
El Hierro, located at the SW end of this island group, is the youngest island with the oldest subaerial rocks dated at 1.12 Ma and is still in juvenile stage of shield growth. The island is the emergent summit of a 280 km2 volcanic shield which rises from a 3800-4000m depth and grows up to 1500 m above sea level.
Although the whole island has been constructed by the volcanic material of two major volcanic edifices, Tiñor in the NE (0.8 -1.2 Ma) and El Golfo edifice in the NW (550 ka-130 ka), rift volcanism (134 ka – AD1793) has been very active after the second major tectonic event (gravitational collapse of El Golfo edifice), specially along the South ridge. Till July 2011 the most recent eruption was the Volcán de Lomo Negro (AD1793) located at the western part of the island.
The products of the Tiñor and El Golfo edifice, massive lava flows, are typical mafic basalts with phenocrystals of olivine and only in El Golfo sequence evolved lava flows (trachytes with phenocrystals of plagioclase feldspars) could be observed. However, the recent rift lavas present varied compositional and textural features.
During the eruption of 2011-2012 a variety of volcanic material has been observed and sampled. On 15 October, bicoloured lava fragments were observed floating on the sea with a bomb-like shape and sizes between 10 and 40 cm. The outer part, black, vesiculated and no more than 1 cm thick, had a basaltic composition, while the inner part was white, highly vesiculated and rich in silica (>60%). This type of fragments was observed only during the first days of the eruption.
On 27 November (and later) new lava fragments were observed while floating and degassing on the sea surface. Many of them were “lava balloons”, with a huge cavity in the centre or fragments of pillow lavas, with sizes between 30 and 200 cm; all of them have a highly vesiculated outer crust. The composition is basaltic-basanitic and sideromelane could be observed most of the times.
In this work, we describe the petrological evolution observed since the beginning of the eruption through the fragments emitted and the geological characteristics of the submarine edifice.