The Miocene PX1 gabbro-pyroxenite intrusion (Fuerteventura, Canary Islands), is interpreted as the shallow-level feeder-zone (0.15-0.2 GPa and 1100-1120°C), to an ocean island volcano. The particularity of PX1 is that it displays a NNE-SSW trending vertical magmatic banding expressed by alternating gabbro and pyroxenite sequences.

The gabbro and pyroxenite sequences consist of metre-thick differentiation units, which suggest emplacement by periodic injection of magma pulses as vertical dykes that amalgamated, similarly to a sub-volcanic sheeted dyke complex. Individual dykes underwent internal differentiation following a solidification front (favoured by a significant lateral/horizontal thermal gradient) parallel to the dyke edges. Pyroxenitic layers result from the fractionation and accumulation of clinopyroxene ± olivine ± plagioclase crystals from a mildly alkaline basaltic liquid and are interpreted as truncated differentiation sequences, from which residual melts were extracted by compaction. Clinopyroxene mineral orientation in pyroxenites (evidenced by EBSD and micro X-ray tomography analysis) display a marked pure shear component, supporting this interpretation. Compaction and squeezing of the crystal mush is ascribed to the incoming and inflating magma pulses. The resulting expelled interstitial liquid was likely collected and erupted along with the magma flowing through the newly injected dykes. Gabbro sequences represent crystallised coalesced magma batches, emplaced at lower rates at the end of eruptive cycles, and underwent minor melt extraction as evidenced by clinopyroxene orientations that record a simple shear component suggesting syn-magmatic deformation parallel to observed NNE-SSW trending shear-zones induced by the regional tensional Miocene stress-field.

The initiation and geometry of PX1 is controlled by the regional extensional tectonic regime whereas rates and volumes of magma depend on source-related factors. High injection rates are likely to induce intrusion growth rates larger than could be accommodated by the regional extension. In this case, dyke tip geometry and the inability of magma to circulate through previously emplaced and crystallised dykes could result in an increase of non-lithostatic pressure on previously emplaced mushy dyke walls; generating strong pure-shear compaction and interstitial melt expulsion within the feeder-zone as recorded by the cumulitic pyroxenite bands and anorthositic collection zones. The whole-rock major and trace-element chemistry of PX1 gabbros and pyroxenites is globally homogeneous and controlled by the cumulate nature of the samples (i.e. on the modal proportions of olivine, pyroxene, plagioclase and oxides). However, small variations of whole-rock trace-element contents as well as trace-element contents of clinopyroxene rims suggest that in-situ re-equilibration and crystallisation has occurred. Additionally, the global homogeneity and presence of complex zoning of rare resorbed clinopyroxene crystals suggest that the PX1 feederzone overlies a periodically replenished and efficiently mixed magma chamber. Each individual dyke of magma thus originated from a compositionally constant mildly alkaline magma and differentiated independently from the others reaching up to 70% fractionation. Following dyke arrest, these are affected by interaction with the trapped interstitial liquid prior to its compaction-linked expulsion (thus stopping the differentiation process). This emplacement model implies that minimum amount of approximately 150 km3 of magma is needed to generate PX1, part of it having been erupted through the overlying Central Volcanic Complex of Fuerteventura.

The radiogenic isotope ratios of PX1 samples reveal the contribution on three end-members during magma genesis. This mixing of the HIMU, EM1 and DMM end-members could reflect the interaction of the deep-seated Canarian mantle plume with a heterogeneous metasomatic and sepentininsed lithospheric mantle. Additionally, the observed trace-element and isotopic variations within the same facies groups could reflect varying degrees of partial melting of the source region, thus tapping more or less large areas of the metasomatised lithospheric mantle during interaction with the plume.

High precision ID-TIMS U/Pb zircon and baddeleyite ages from the PX1 gabbro samples, indicate initiation of magma crystallisation at 22.10 ± 0.07 Ma. The magmatic activity lasted a minimum of 0.48 to 0.52 Ma. 40Ar/39Ar amphibole ages are of 21.9 ± 0.6 to 21.8 ± 0.3, identical within errors to the U/Pb ages. The combination of the 40Ar/39Ar and U/Pb datasets imply that the maximum amount of time PX1 took to cool below amphibole Tc is 0.8 Ma, suggesting PX1 lifetime of 520 000 to 800 000 years. On top of this, the coexistence of baddeleyite and zircon in a single sample is ascribed to the interaction of PX1 with CO2-rich carbonatite-derived fluids released from the host-rock carbonatites during contact metamorphism 160 000 years after PX1 initiation. These ages are in agreement with the emplacement model, implying a crystallisation time of less than 1 to 5 years for individual dykes.