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Tectonically induced vertical magmatic layering in the PX1 pyroxenite-gabbro intrusion, root-zone of an ocean island volcano, Fuerteventura (Canary Islands).

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The Miocene PX1 gabbro-pyroxenite intrusion located in the Basal complex of Fuerteventura displays a remarkable vertical magmatic layering. This 3.5 by 5.5 km alkaline pluton was emplaced over a short period of time between 21.2 $\pm$ 0.2 Ma and 19.5 $\pm$ 0.4 Ma (Ar/Ar on amphibole) in Jurassic oceanic sediments overlying the Atlantic oceanic crust. Pressure and temperature estimates using clinopyroxene chemistry (Soesoo, 1997) yield 2Kbar and 1050 to 1100˚C, respectively.

The vertical compositional and textural layering shows no gravitational component and is N20 trending with a pseudo-vertical dip, parallel to the regional transtensive tectonic regime. This magmatic layering can be seen at all scales. On the intrusion scale, five 100m-wide alternating gabbro and pyroxenite bands have remarkable linear and vertical contacts. At sample scale, 0.1 to 1 metre-thick horizons are expressed by crystallisation sequences ranging from olivine-bearing pyroxenites to clinopyroxenites to plagioclase-pyroxenites. These vertical features are also underlined by syn- to post-magmatic sinistral shearing, which generated schistosity in the pyroxenites and banding in the gabbros. Plastic deformation of minerals and periodic reactivation of shear planes are common.

Pyroxenites result from the fractionation and accumulation of clinopyroxene crystals from a mildly alkaline basaltic liquid, from which variable proportions of interstitial liquid was expulsed. The latter is documented in rare collection zones like anorthosite

dykelets and pockets, the rest having presumably been erupted. Conversely, gabbro horizons underwent minor melt extraction and are more representative of liquids. Differential magmatic compaction and subsolidus deformation from one gabbro-pyroxenite band to the next indicates the chronology of magma emplacement, the oldest pyroxenites recording the strongest deformation and the youngest gabbros barely revealing any dynamic textural fabrics. A preliminary EBSD and micro-tomography study of PX1 gabbro and pyroxenite samples reveals that a marked pure shear component exists in compacted bands, whereas a slight simple shear component is noticeable in the ultimate non-compacted gabbro band. The intrusion was therefore built up by periodic injection of magma batches (the metre-wide sequences) in a progressively widening dyke system controlled by the regional stress field, each new magma pulse compacting the previous ones.

In conclusion, the remarkable vertical magmatic layering in the PX1 pluton was generated by a transtensional regional tectonic regime, which also controlled the frequency of injection of magma pulses and, therefore, the growth rate of the pluton.

Reference: Soesoo A., 1997. GFF volume 119, pp. 55-60.