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Feeder-dyke segmentation induced by rift spreading in eruptive fissures of Tenerife (Canary Islands)

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Volcanic fissures are common structures that are mainly related to effusive eruptions. A fissure eruption is fed by a dyke coinciding in trend with that of the eruptive fissure. The physical connection between the eruptive products and the feeder dyke is rarely exposed and rarely reported. In the Northeast Rift Zone (NRZ) of Tenerife, however, local erosion has made possible to study a feeder dyke in direct connection with the volcanic products of a fissure eruption. These outcrops thus offer a rare opportunity to study dyke segmentation in relation to surface stresses. The mean direction of the NRZ can be inferred from the alignment of 250 vents along the rift zone, and by the trend of the morphostructural ridge of the rift. Based on these data, the general trend of the NRZ is between N55°E and N50°E. The eruptive fissure is located in the southwestern part of the NRZ. It is 2.4 km long and is composed of more than 15 vents aligned along a mean direction of N40°E. The main vent is a cinder cone from where most of the material was erupted. The other vents are mainly small spatter cones, chimneys and some centres from which lava flows were issued. At several localities the transition from the feeder dyke to spatter cones, chimneys and lava flows is excellently exposed. The feeder dyke has a mean dip direction of 318° and is subvertical, dipping about 76°. Both the eruptive fissure and the feeder dyke have an echelon pattern. In plan view, this pattern is consistent with a dextral shear at the surface and, assuming subvertical dyke propagation, with the development of a mixed mode I and III fracture. The trend of the dyke is N40°E, making an angle of 10°-15° with the trend of the NRZ. We interpret the dyke segmentation as resulting from its being oblique to the regional trend of the maximum tensile stress which, we infer, is perpendicular to the general strike of the NRZ.