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Structural evolution of lamprophyric dikes in Lailai, northeastern coast of Taiwan, deduced from mesoscopic structures in dikes and country rocks

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Lamprophyric dikes are standing in right-stepping en echelon up to 2.3 meters high within the Oligocene Tatungshan formation on the Lai-Lai wave-cut platform in the northeastern coast of Taiwan. The marine platform composed mainly of argillite is the extension of Hsuehshan range, which has the tallest peak of 3,886 m high in Taiwan. The dikes formed at depth in the late Miocene of 9±1.1 Ma ago are exposed on the marine platform nowadays due to the exhumation and Penglai orogeny resulting from the collision of Eurasian plate and Philippine Sea plate, which began in Pleistocene of 5-6 Ma ago. In consequence, folds, faults, joints and other structures are associated with them.

In this study, the distribution of the dikes and fractures were mapped by conducting accurate surveys with a total station theodolite and orthorectifying aerial images taken by an unmanned aerial vehicle in different elevations. Electrical resistivity exploration was performed to decipher the arrangement of the dikes underground and the characteristics of the faults. The associated mesoscopic structures were delineated by mapping at a scale of 1: 40 in the field.

We infer that the dikes was formed at depth of approximately 2.4 kilometers according to the thickness of overlaying sedimentary rocks formed from late Oligocene to late Miocene. Thus, it excludes the possibility that fractures existed before the lamprophyric magma intruded into the country rocks. Our observations help restore the original status of the current 19 dike segments. We conclude that the lamprophyric magma forcedly and vertically intruded into the Oligocene rocks and the direction change of maximum principle stress at depth of 2.4 kilometers resulted in three or more right-stepping en-echelon dikes.