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Temporal-spatial relationships in the Auckland volcanic field: insights from geophysical studies

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The Quaternary Auckland volcanic field comprises nearly fifty small monogenetic volcanoes of mainly alkali basalt composition, sourced from the upper mantle at about 80 km depth. Structural controls on the location of both the field and individual volcanoes are poorly understood. Geophysical evidence shows that the field is coincident with a deep-seated crustal discontinuity, but there is little evidence for shallow crustal controls on the location of vents. Paleomagnetic data have provided unique insight into eruption patterns within the Auckland field, temporally linking at least five volcanoes which may have erupted contemporaneously. There appears to be no obvious structural relationship between these five volcanoes; they are spread over a wide area of the field though are located at, or south of, the crustal discontinuity identified from the regional geophysical data. There is further paleomagnetic evidence for contemporaneous eruption from some adjacent vents in the field that are apparently aligned along regional structural trends. However there are also cases where eruptions from similarly aligned adjacent vents were clearly not contemporaneous. The estimated total DRE volume of the deposits from the five temporally linked volcanoes ($0.13\ km^3$) is about equivalent to that produced by a typical moderate-sized cone eruption in the field, indicating that no significantly greater magma flux occurred in this event. If the five magma batches were sourced from different parts of the melt pool (at least three of these five volcanoes exhibit a different geochemistry), it would suggest that magma overpressure was concurrent throughout a large volume of the reservoir and that magmas rose to the surface along individual pathways, perhaps initiated by a transient increase in regional extension rate related to ongoing Quaternary extension in the

nearby Hauraki rift.