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Early Miocene Kırka-Phrigian caldera, western Anatolia - an example of large volume silicic magma generation in extensional setting

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Large rhyolitic ignimbrite occurrences are close connected to the Early Miocene initiation of extensional processes in the central-west Anatolia along Taşvanlı-Afyon zones. Field correlations, petrographical, geochemical and geochronological data lead to a substantial reinterpretation of the ignimbrite surrounding Kırka area, known from its world-class borate deposits, as representing the climatic event of a caldera collapse, unknown up to now and newly named "Kırka-Phrigian caldera". The caldera, which is roughly oval (24 km x 15km) in shape, one of the largest in Turkey, is supposed to have been formed in a single stage collapse event, at $\sim$19 Ma that generated huge volume extracaldera outflow ignimbrites. Transtensive/distensive tectonic stresses since 25 Ma ago resulted in the NNW-SSE elongation of the magma chamber and influenced the roughly elliptical shape of the subsided block (caldera floor) belonging to the apex of Eskişehir–Afyon-Isparta volcanic area. Intracaldera post-collapse sedimentation and volcanism (at $\sim$ 18 Ma) was controlled through subsidence-related faults with generation of a series of volcanic structures (mainly domes) showing a large compositional range from saturated silicic rhyolites and crystal-rich trachytes to undersaturated lamproites. Such volcanic rock association is typical for lithospheric extension. In this scenario, enriched mantle components within the subcontinental lithospheric mantle will begin to melt via decompression melting during the initiation of extension. Interaction of these melts with crustal rocks, fractionation processes and crustal anatexis driven by the heat contained in the ascending mantle melts produced the silicic compositions in a large crustal reservoir. Such silicic melts generated the initial eruptions of Kırka-Phrigian caldera ignimbrites. The rock volume and geochemical evidence suggests that silicic volcanic rocks come from a long-lived magma chamber that evolved episodically; after caldera generation there is a shift to small volume episodic rhyolitic, trachytic and lamproitic volcanism, the last ones indicating a more primitive magma input with evident origin in an enriched mantle lithosphere.
The volcanic rock succession provides a direct picture of the state of the magmatic system at the time of eruptions that generated caldera and post-caldera structures and offer an excellent example for silicic magma generation and associated potassic and ultrapotassic intermediate-mafic rocks in post-collisional extensional setting.