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Locating ignimbrite source using volcanologic and magnetic proxies: the Afyon-Eskisehir case study (Western Anatolia)

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This study exploits volcanologic and magnetic techniques to the investigation of the Early-Middle Miocene pyroclastic sequence exposed in the ∼120 x 80 km area comprised between the cities of Eskisehir to the North and Afyon to the South (Western Anatolia), in order to locate the source by combining flow directions inferred by field analysis (clasts embrication and sedimentary structures) and those obtained by the analysis of magnetic fabric on the ignimbrite deposits (anisotropy of magnetic susceptibility, AMS, and anisotropy of remanent magnetization, ARM). Moreover we integrated directional flow data with preliminary isopleth and isopach maps of the air-fall deposits. The sequence belongs to the most important magmatic activity in the region, named Kırka-Afyon-Isparta Volcanism (KAIV), which originated a calc-alkaline pyroclastic sequence intercalated with some lava and breccias, and the products of an effusive activity with alkaline affinities lasted until Quaternary times. Stratigraphy points out to the presence of two main eruptive events which originated several ignimbrite units distinguished on the basis of macroscopic features (mineralogy and texture) and areal distribution of the deposits; the overall areal extension and volume of the pyroclastic products is ∼8,000 km2 and ∼200 km3. The oldest event generated the Akcakaya ignimbrites, which are exposed in the Northern part of the area; lacustrine sedimentary deposits separate them from the younger Demirli ignimbrites, cropping out in the Southern part of the area; both the Akcakaya and Demirli ignimbrites are overlain by lava sheets. Magnetic sampling has been carried out at 20 areal distributed localities in the two ignimbrite deposits (30 sites, 600 specimens); each section was sampled from 1 to 3 sites at different stratigraphic height. Rock magnetic measurements point out to the presence of Ti-magnetite as the main magnetic carrier. At some localities AMS fabric is vertically consistent through the stratigraphy and with nearby field indicators, elsewhere it varies vertically along the section. Magnetic fabric is always well defined and characterized by a sub-horizontal or gently embricated magnetic foliation (inclination < 30°). On the basis of preliminary magnetic and sedimentary-inferred flow directions data, two sources have been identified. The source of the Demirli ignimbrites has been constrained within an area about 30 km NE from the city of Afyon, where the evidence of an existing caldera was already been reported. Directional data about the Akcakaya ignimbrites are fewer, but their comparison with isopleth and isopach maps indicates a source close to the Turkmendag mountain, about 50 km SW from the city of Eskisehir.