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VERSITA

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Fluvial stacking due to plate collision and uplift during the Early Pleistocene in Cyprus

Research Article

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Abstract: Southern Cyprus is situated within a mosaic terrane that has been fragmented between the northward drifting African and Arabian plates and the Eurasian plate. Enormous uplift of the earth mantle in the Tróodos Mountains is explained by two models. The subduction model explains subduction along the Cyprean arc to be the driving force for uplift whereas after the restraining bend model westward squeezing of Cyprus along strike-slip faulting is responsible for the enormous uplift at restraining bends. Since its emergence as an island in early Miocene times, landscape formation on Cyprus has been strongly controlled by this uplift. Until the Plio-Pleistocene, a strait belt separated the southern unroofed ophiolitic core region–the Tróodos Mountains–from the folded Kyrenia range to the north. This former sea basin, nowadays the Mesaoría Basin, is linked with the Tróodos Mountains by a dissected glacis with a thick cover of river deposits. The highest and oldest river deposits (Apalós Formation) were studied in the Vlokkariá hill southwest of Lefkosía. The 45.5 m thick Apalós Formation of Early Pleistocene age exhibits 24 sedimentary units (Fluviatile Series). Their magnetostratigraphical characters align with the Matuyama chron including the Olduvai and Jaramillo subchrons thus comprising about 1.15 Ma within the Early Pleistocene. This fluvial stack indicates a very flat and deeply lying river environment flowing from a slowly uplifting Tróodos hinterland. It happened during the end of Early Pleistocene when the enhanced Tróodos uplift started the dissection of the stacked river plain.

Keywords: Apalós Formation • Nicosia Formation • fluviatile stack • palaeomagnetism • Matuyama chron

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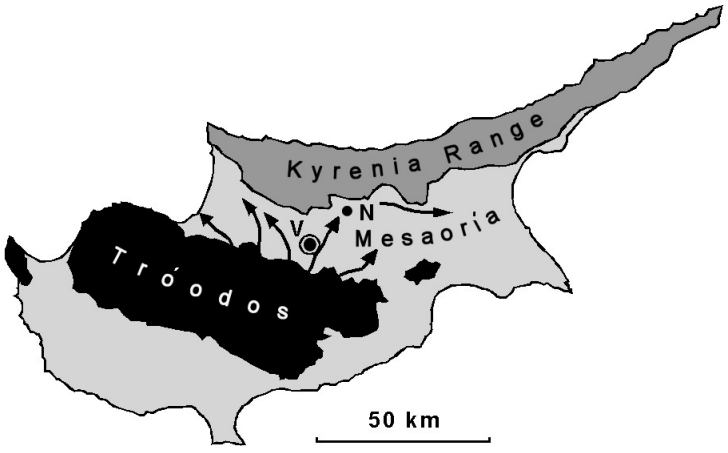

Figure 1. Location of the Vlokkariá Section (V) in Cyprus. N = Nicosía (Lefkosía). Arrows mark the main drainage directions within the Mesaoría Basin. The Vlokkariá is situated near the water divide between the western and eastern drainage of the Mesaoría Basin.

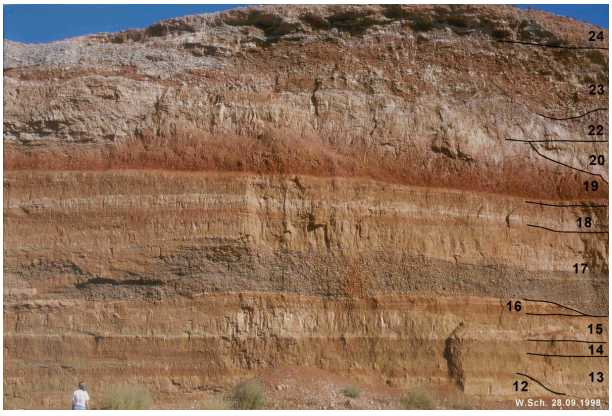

Figure 2. Detail of the Vlokkariá cliff wall. The cliff exhibits 12 of total 24 Fluviatile Series (units) of the Vlokkariá section. The detail (photograph) includes unit 12 to 24 except 21. Photo: W. Schirmer 28.09.1998.

extended downwards by using a rut, thus adding a 4.8 m vertical section to the cliff with an additional 5 fluviatile units exposed. In 2005 an additional 146.5 m long and 2.5–3 m deep trench was excavated, extending the section down through the base of the Apalós Formation into the Nicosia Formation (Figure 3). Cliff, rut and trench exposed a total of 24 stacked fluviatile units (Figure 4).

The sediments of the Apalós Formation clearly show cyclic deposition, which is diagnostic for the Fluviatile Series sensu Schirmer [11]. Each cycle starts with an unconformity. Generally, the base over this unconformity is formed by a channel facies (gravel bed) consisting of dark ophiolitic rudites with small amounts of Tertiary carbonate deposits and with ophiolitic medium grained sand of dark olive colour. The gravel bed is overlain by a graded flood deposit that normally starts with medium to fine sandy loam and passes upwards to silty loam. The flood deposit is topped by a floodplain soil, the intensity of which changes from cambisol through luvisol to nitisol.

Figure 3. Vlokkariá cliff and the 146.5 m long artificial trench at its foot. The trench exhibited the basal 12 of total 24 Fluviatile Series of the Vlokkariá section. In the background the outskirts of the town of Nicosia in front of the Kyrenia Range. Photo: W. Schirmer 12.11.2005.

The gravelly channel facies in many cases is locally incised into the upper parts of an older unit; sometimes it has removed the uppermost horizons of the soil topping the underlying unit. In rare cases, as in unit 16, the soil topping the underlying unit was completely removed

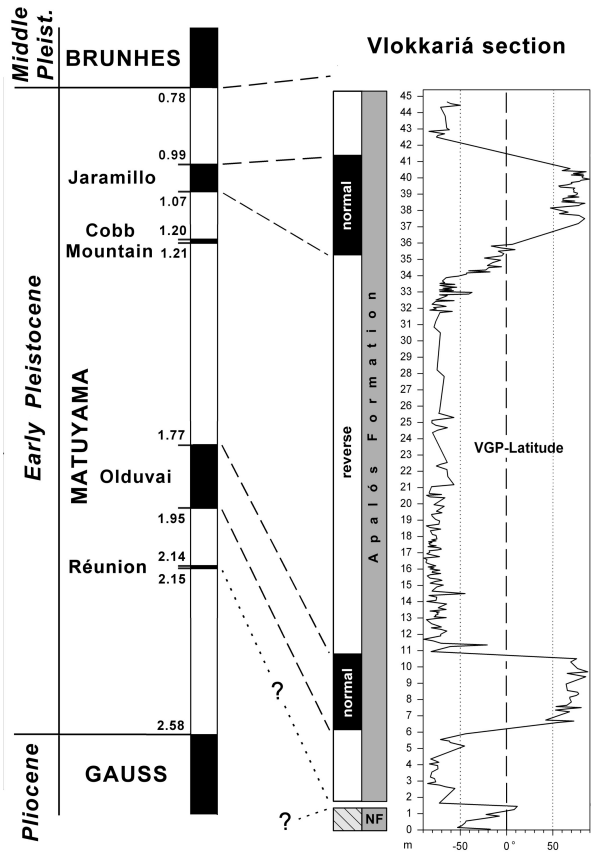

Figure 8. Magnetostratigraphic correlation of the polarity pattern observed at the Vlokkariá section (right) with a geomagnetic polarity timescale (modified from Berggren et al. [12]) (left). Black (white) bars show normal (reverse) polarities. Hachured bar represents zone of uncertainty below a gap between Apalós Formation above and Nicosia Formation (NF) below. Numbers in the stratigraphical scale are million years.

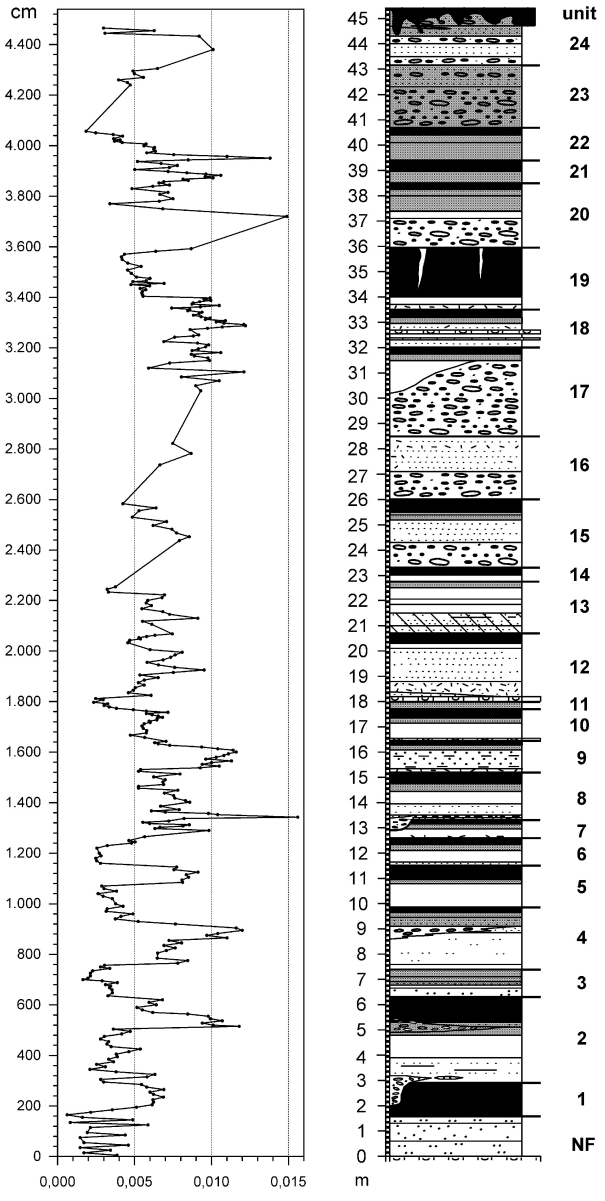

Figure 9. Vlokkariá section. Susceptibility (left) in comparison to geological strata (right). Unit 1-24 represent the Apalós Formation, NF the Nicosia Formation.

The 24 cycles of the Apalós Fluviatile Series in the Vlokkariá area lie at similar elevation with a tendency toward superposition. As they form the first terrestrial deposits at the northern rim of the Tróodos Mountains, a very flat and deeply lying river environment is considered. This long lasting fluvial sediment stacking either may have compensated an oversteepened relief prior to the Apalós Formation, or more likely may have resulted from a very gentle and steady uplifting of the Tróodos hinterland. By contrast, enhanced Tróodos uplift started the dissection of the stacked river plain at the end of the Early Pleistocene. This dissection continued through the Middle Pleistocene, leaving some terrace accumulations in between. Thus, the Tróodos uplift shows a pronounced pulsing history.

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