Field-based correlation and quantitative dating of Upper Pleistocene-Holocene shallow-marine and fluvial terrace deposits in the Polis and Paphos regions of western Cyprus (E Mediterranean)

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Background

Upper Pleistocene to Holocene fluvial and shallow-marine deposits, preserved as raised terraces, represent key sedimentary archives of past climatic, tectonic, and glacio-eustatic sea-level changes. In W Cyprus, terrace deposits provide an excellent opportunity to investigate the relative influences of regional and local tectonics, climatic change, and sea-level fluctuations on sedimentation. This project focused on two contrasting areas: an active extensional basin in NW Cyprus (Polis graben), and an uplifted fault block in SW Cyprus (Paphos-Pissouri; Figure 1). Elsewhere in Cyprus, terrace deposition has been closely linked to regional tectonic uplift and eustatic sea-level changes, particularly during the Early to Mid-Pleistocene. This uplift is a result of collision of the leading edge of the N African plate (Eratosthenes Seamount) with Eurasia (Turkey) since the Early Pleistocene, which has led to tectonic escape and slab rollback into old oceanic crust to the west in the Herodotus basin. Climatic variation during interglacial-glacial cycles dominated the later Pleistocene to Holocene sedimentation. This research complements and extends beyond my PhD research funded by the Natural Environment Research Council as it allows additional study and comparison of a different area with a different structural setting (i.e. block uplift) compared to my PhD study area (i.e. fault-bounded graben).

Figure 1 View from the highest terrace erosional surface in SW Paphos-Pissouri region.

Field Report

I conducted 2 weeks of fieldwork during the spring and autumn of 2024. My fieldwork in the SW Pissouri, which was specifically funded by the Postgraduate Student Bursary from the Mineralogical Society (and several other funding bodies; please see below) involved detailed sedimentary logging, terrace mapping, structural field measurements and sample collection for petrographic analysis. Four main terrace erosional surfaces, with or without sediments, were identified and mapped. The fluvial terraces consist of matrix-supported polymictic conglomerates, colluvial deposits, red terra rossa paleosols, and calcrete cappings. The shallow-marine terraces exhibit transgressive-regressive cycles composed of polymictic conglomerates with reworked planktic foraminifera, overlain by bioclastic limestones rich in calcareous red algae, bivalve and gastropod shell fragments, echinoderm spines and planktic foraminifera, shallow-marine sands, and cross-bedded aeolianites. Thin sections of the fluvial and shallow-marine terrace sediments (Figure 2), prepared at the University of Edinburgh, are currently being studied.

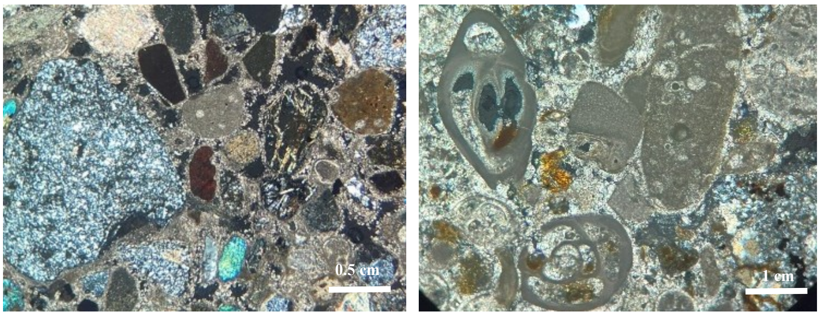

Figure 2 Photomicrographs of a shallow-marine conglomerate with poorly-sorted, sub-rounded clasts with planktic foraminifera (left) and a bioclastic limestone with planktic foraminifera, calcareous red algae and reworked lithoclasts (right).

For the absolute dating aspect of this research, it was decided to focus on the Polis graben, as this would allow comparison and correlation with previous (and planned new) U-Series dating of solitary corals in this area. With the help of two of my PhD supervisors, Prof. Alastair Robertson and Dr. Tim Kinnaird, I collected 30 samples of fine-grained, shallow-marine and fluvial terrace deposits in the Polis graben for optically stimulated luminescence (OSL) dating. As OSL dating of terrace sediments is a recent development in Cyprus, this is an excellent opportunity to apply this method in a new study area. In situ luminescence profiling on freshly excavated sediment surfaces under light-safe conditions (i.e. under a black, opaque tarpaulin) was carried out using a portable luminescence reader (Figure 3). This acted as a screening method to relatively quickly assess the luminescence characteristics in the field, and to help determine suitable spot sampling sites for full dating analysis later at the OSL laboratory at the University of St. Andrews. Following fieldwork, samples have been prepared and processed to calculate dose rates, with promising initial results for achieving absolute ages.

Figure 3 In situ luminescence profiling of an alluvial deposit (left) and an in situ gamma-ray spectrometer dose rate measurement of a fluvial sand deposit (right) for OSL dating.

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