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Lake level changes and their paleo-climatic implications at the middle Pleistocene excavation of MAR-1, southern Greece

Ines Bludau^{1,2}, Max Weiss¹, Ellen Schnabel^{1,3}, Nicholas Thompson¹, Vangelis Tourloukis¹, Panagiotis Karkanias⁴, Eleni Panagopoulou⁵, Katarina Harvati^{1,2}, and Annett Junginger^{1,2}

¹Department of Geosciences, Eberhard Karls University Tuebingen, Tuebingen, Germany

²Senckenberg Centre for Human Evolution and Paleoenvironment (S-HEP), Tuebingen, Germany

³Institute of Geosciences, Johannes Gutenberg University Mainz, Mainz, Germany

⁴The Malcolm H. Wiener Laboratory for Archaeological Science, American School of Classical Studies at Athens, Athens, Greece

⁵Ephoreia of Palaeoanthropology-Speleology of Greece, Athens, Greece

In the fossil-rich sediments of the Megalopolis Basin, southern Greece, the remains of an ancient paleo-lake alternate between detrital units and lignite seams deposited during the Middle Pleistocene. The detrital sediments of MAR-1 (480-420 kyr) between two lignite seams are where lithics and elephant bones with cut-marks have been systematically excavated indicating hominin activity along a paleo-shoreline circa 440 kyr. Based on current knowledge, lignite seams formed during interglacials, while the silty-clay-rich deposits in between were deposited under glacial conditions. However, the paleoenvironmental and paleoclimatic conditions on shorter timescales, leading to the preservation of hominin activity in the area, remain largely unknown. In order to reconstruct the paleo-environment including paleo-lake levels and thus sedimentation patterns and their governing paleo-climatic factors, we analyzed a high resolution 5-meter long sediment sequence from the archaeological site MAR-1. For the reconstruction, a multiproxy approach was applied using microfossils, grain-size, and geochemical analysis such as total organic carbon, total inorganic carbon, X-ray diffraction, and conventional X-ray fluorescence. Diatoms were often too corroded to be of use, most likely due to a combination of alkaline water conditions and the influence of silicate sponges. The results of the analyses revealed that MAR-1, located between lignite unit II and III, experienced multiple lake level oscillations mostly following insolation changes suggesting that several short-term wet-dry-wet cycles occurred during the investigated period, which must have impacted flora and fauna, including hominins, in the area. This research was conducted under the auspices of the Ephoreia of Paleanthropology and Speleology, Greek Ministry of Culture, and was supported by the European Research Council (PaGE, CROSSROADS).