Terminal Pleistocene habitation structures and riverine palaeoenvironments of the Middle Nile Valley, Sudan: evidence from Affad 23

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The Epipalaeolithic of the Levant saw crucial changes in subsistence behaviour prefiguring the transition to sedentism and cultivation, but much less is known of contemporary developments in the Middle Nile Valley. Here Affad 23, a 16 000-year-old settlement, on the margins of a multi-channel floodplain that was periodically flooded, offers exceptional insights. Unusually good preservation includes remains of pits and postholes indicating the construction of temporary shelters and specialised functional zones. The Affad 23 community successfully exploited a wide range of riverine resources and created a highly organised seasonal camp adjacent to convenient and well-stocked hunting grounds. Surprisingly, they continued to exploit Levallois-like tools rather than adopting new technologies (e.g. microliths) then evolving in Upper Egypt.

Keywords: Sudan, Nile, Terminal Pleistocene, Epipalaeolithic, epi-Levallois, settlement, post-hole, hearth

SUPPLEMENTARY INFORMATION

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OSL methodology

Samples were dried at 20°C, with the weight of the samples varying from 500g to 550g. Uranium, thorium and potassium measurements were undertaken using a Natural Radionuclide Analyser (Mazar-01) with a measurement time of 30 hours. On the basis of the results, annual dose rates for the samples were calculated (Table S1). Calibration coefficients declared by the manufacturer were applied. While calculating the annual dose rate (in Gy/Ka), the influence of cosmic radiation was also taken into account (Yokoyama *et al*. 1982).

The quartz fraction was separated using the gravitational method with grains of 63–100μm diameter selected. Grains were then etched with 10% hydrochloric acid solution and 20% H_2O_2 solution. The final stage of preparation was one-hour etching of the sample with hydrofluoric acid. OSL measurements were conducted using a Manual Reader-Analyser TL/OSL RA'94 manufactured by MIKROLAB, Poland. Quartz aliquots of 0.5mg were stimulated with 470-nm blue light. Using these results an equivalent dose (ED) was calculated (Table S2). The dose was determined using the regeneration method (Murray & Wintle 2000). The OSL age of the sediments was calculated by division of the equivalent dose (ED) by the annual dose rate (D_r). The error of measurement was estimated to be ± 15%.

Table 1. Determination of annual (environmental) dose rates of OSL samples from Affad Basin.

Sample	Laboratory number	U	Th	K	Cosmic	Dose rate	Error
			Bq/kg		Gy/ka	Gy/ka	
OSL-1	UJK-OSL-34	11.89	12.96	273.06	0.150	1.5621	0.047
OSL-2	UJK-OSL-35	8.87	13.52	260.21	0.150	1.4691	0.044

OSL-4	UJK-OSL-36	5.59	13.16	243.23	0.140	1.3282	0.040
OSL-10	UJK-OSL-37	7.92	14.64	291.53	0.150	1.5758	0.047
OSL-20	UJK-OSL-38	13.30	23.67	353.65	0.150	2.0763	0.062
OSL-21	UJK-OSL-39	19.60	13.52	358.78	0.140	2.0055	0.060
OSL-22	UJK-OSL-40	2.94	17.56	265.10	0.150	1.3251	0.040
OSL-23	UJK-OSL-41	9.83	11.50	231.34	0.140	1.3420	0.040
OSL-24	UJK-OSL-42	5.75	16.01	241.69	0.140	1.3845	0.042
OSL-25	UJK-OSL-43	17.67	19.73	284.55	0.140	1.8470	0.055
OSL-26	UJK-OSL-44	8.45	19.01	318.70	0.140	1.7558	0.053
OSL-27	UJK-OSL-45	12.48	15.75	255.29	0.120	1.5424	0.046

Table 2. Dose rates, equivalent doses and OSL ages for Affad samples.

Sample	**Laboratory number**	**Dose rate Gy/ka**	**Error**	**ED Gy/ka**	**Date (ky)**
OSL-1	UJK-OSL-34	1.5621	0.047	23.9001	15.3±1.68
OSL-2	UJK-OSL-35	1.4691	0.044	23.3587	15.9±1.75
OSL-4	UJK-OSL-36	1.3282	0.040	28.0250	21.1±2.32
OSL-10	UJK-OSL-37	1.5758	0.047	23.7946	15.1±1.66
OSL-20	UJK-OSL-38	2.0763	0.062	33.2208	16.0±1.92
OSL-21	UJK-OSL-39	2.0055	0.060	46.5276	23.2±3.95
OSL-22	UJK-OSL-40	1.3251	0.040	20.8041	15.7±1.73
OSL-23	UJK-OSL-41	1.3420	0.040	35.2946	26.3±2.89
OSL-24	UJK-OSL-42	1.3845	0.042	35.8586	25.9±2.85
OSL-25	UJK-OSL-43	1.8470	0.055	31.2143	16.9±1.86
OSL-26	UJK-OSL-44	1.7558	0.053	47.0554	26.8±3.22
OSL-27	UJK-OSL-45	1.5424	0.046	52.5958	34.1±4.43

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