Report on OSL dating at Olieboomspoort

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Note: this permit concerns non-archaeological material (sediment samples and rocks), which will be kept at the dating facility in Denmark.

Quartz was extracted in the usual manner from the four sediment samples. We attempted to extract K-feldspar as well, but there was not enough feldspar in the sediment samples to make sensible measurements. We measured both field as well as saturated water content (see table below)

Sample ID	Field water content (%)	Saturated water content (%)
197601	2.4	35.2
197602	1.6	45.1
197603	1.0	39.8
197604	0.2	30.3

As the sediments presumable dried out a little, I would estimate that the most appropriate water content to use is 5%. In the data below, we have currently used the field water content.

Dose rates were determined using high-resolution gamma spectrometry. Activity concentrations were converted into dry dose rates using conversion factors specific to the decay chains involved. We converted the measured specific activities into gamma and beta dose rates following the conversion factors given in Guérin et al. (2011). Before counting, crushed and homogenized samples were mixed with wax, cast in a fixed cup-shaped geometry, and stored for a minimum of 21 days (>five 222Rn half-lives) to ensure equilibrium between 222Rn and 226Ra. We also assume that the present day burial depths represent the lifetime burial depths and cosmic ray contributions are based on Prescott and Hutton (1994). A summary of radionuclide concentrations measured and derived quartz dose rates (using the field water contents) are given below.

Sample	Depth	W.C.	^{238}U		^{226}Ra		^{232}Th		^{40}K		Dry dose rate		Dry dose rate		Total dose rate	
	cm	%	Bq/kg	s	Bq/kg	s	Bq/kg	s	Bq/kg	s	Gy/ka	s	Gy/ka	s	Gy/ka	s
197601	47	2.4	58	7	78	1	64	1	171	7	1.41	0.05	1.61	0.07	3.05	0.03
197602	67	1.6	52	8	33	1	37	1	556	11	1.72	0.03	1.28	0.03	3.02	0.02

197603	111	1.0	31	2	33	0	59	0	201	3	1.09	0.02	1.25	0.03	2.36	0.02
197604	115	0.2	27	2	29	0	66	0	192	4	1.08	0.02	1.31	0.03	2.41	0.01

Do your concentrations for #536 convert to:

beta dry: 0.99 Gy/ka

gamma dry: 0.90 Gy/ka

For the OSL dose measurements using the 180-250 µm fraction, we have, at his point, measured standard multi-grain aliquots for all four samples as well as single-grain aliquots for the two young samples, where incomplete bleaching may be a problem. We are hoping to also do single-grain measurements for 197603, but this won't be possible to report upon until we are allowed back into work. Anyway, the quartz is excellent from an OSL point of view, i.e. VERY bright, fast-component dominated (>99%), no detectable feldspar contamination, good recycling, small recuperation, D_0-values of approx. 85 Gy (i.e. reliable dose estimation at least up to 150 Gy), no significant dependence of choice of thermal pretreatment, low thermal transfer (consistent with zero) and acceptable dose recovery ratios (within ±10% of unity). In the Tabel below, we summarise the main dose results.

Sample	**Depth (cm)**	**Multi-grain**			**Single-grain**				
					CAM				
		D_e (Gy)	**s**	**n**	**D_e (Gy)**	**s**	**n**	**OD (%)**	**s**
197601	47	7.4	0.3	33	4.9	0.5	123	102	7
197602	67	15.8	0.8	21	9.9	0.8	102	73	6
197603	111	131	7	23					
197604	115	136	7	20					

For the two youngest samples (197601 and 197602) we have a little bit of incomplete bleaching to deal with, so we need to undertake minimum age modelling. There are some uncertainties associated with doing this, but currently I would estimate the burial dose to be approx. 2 and 2.5 Gy, respectively. The preliminary OSL ages are given below:

Sample	**Depth**	**Multi-grain**			**Single-grain (MAM_{UL}-3)**	
	(cm)	**Age (ka)**	**s**	**n**	**Age (ka)**	**s**
197601	47	2.4	0.2	32	0.7	0.1
197602	67	5.2	0.4	21	0.8	0.3
197603	111	56	4	22		
197604	115	57	4	20		