PRELIMINARY REPORT ON THE SEDIMENTARY DEPOSITION AT "THE MARKET" SITE, THE CRADLE OF HUMANKIND VISITOR CENTRE—MAROPENG, STERKFONTEIN (2527DC), GAUTENG PROVINCE, SOUTH AFRICA.

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Research description

A request was made to assess if an artefact bearing layer, found at the open air market site at Maropeng, is a depositional layer or a sedimentary layer caused by bioturbation or other paedogenic processes. Previous reports describe the site as having a 2% possibility of any archaeological deposit being found (K. Kuman, pers. comm. and newspaper articles). The deposit was noted as a "bioturbation zone" within the sedimentary deposits, and only one flake had been exposed during the original assessment provided to the developers.

A visual inspection was made on the 21st September 2005, where several surface artefacts were found within the boundaries of the site. On inspection of the road cut over the open circular trench of the open air market site (Figure 1), the open sedimentary stratigraphy shows a white line of about 5 to 40 cm, at 75-120 cm below the surface. This white line contains rounded quartz gravel, pisiolites, dolerite artefacts, and haematitic clays. The sediment below the surface (above the artefact bearing layer) is composed of a semi compacted red clay soil. The sediment below the artefact bearing layer is also composed of semi compacted red soil which has the same colour and texture of the sedimentary layer above the artefact bearing layer.

Taking in consideration the compactness of the two red soil layers, and the striking difference of the artefact bearing layer, it appears that the artefact bearing layer has been accumulated within a very short time, where the material has probably collected on the surface due to water displacement. Subsequently a further layer of red clay soil has accumulated on the surface. It is possible that what may have been misinterpreted as a bioturbation layer is in fact a surface accumulation of gravels moved downhill by water, and accumulated in what was probably a small depression on the ancient surface. There is the possibility that water moved material and accumulated it in a direction controlled by two dolerite lava flows nearby (outcropping).

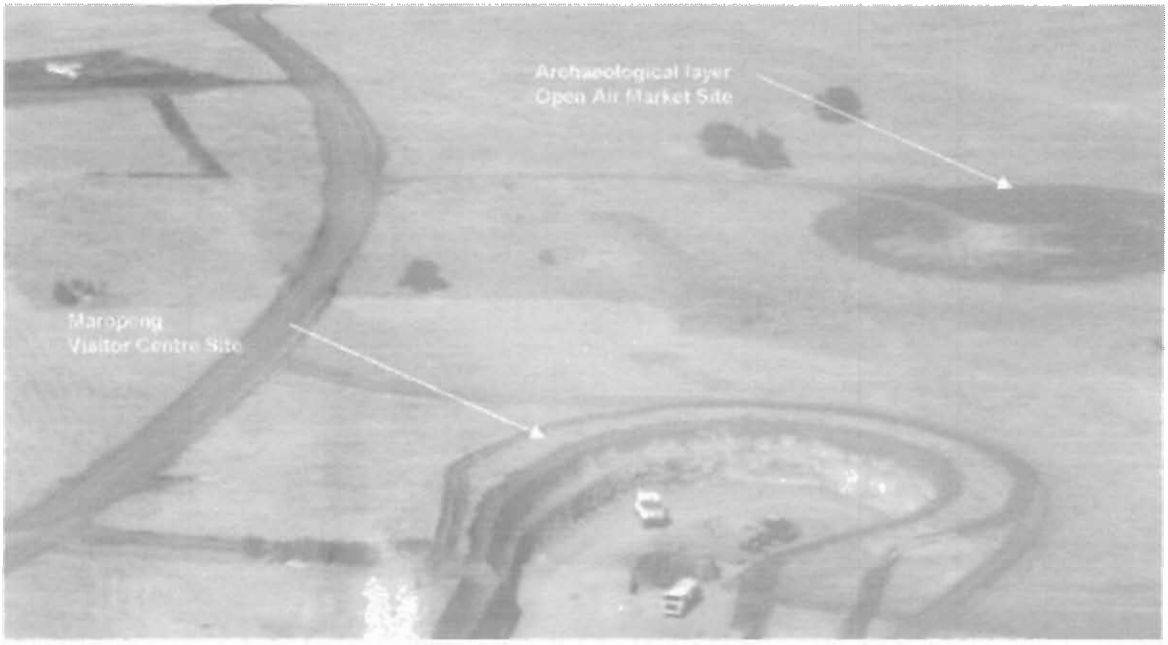

Figure 1. The Maropeng site (detail) as it was on 19th July 2004 (photo courtesy of the developers). The thin white line in the photograph outlines the sedimentary layer on the open market site (arrow) shows the extent of the possible archaeological deposit. This sedimentary layer has been found to be artefact bearing, and is continuous throughout the circular excavation.

These assumptions need to be tested. If the site formed during a wet period in its depositional history, the event that formed the artefact bearing layer may yield information about formation processes and environmental change in the area.

Sedimentary analysis:

A preliminary analysis of the sedimentary deposit was undertaken, where three small samples were analysed for grain size. Three samples of sediment were taken from the exposed layers near the road entrance to the open air market site (Figure 2).

Sample MAR01s1 is a 5 x10x 5 cm spit, taken at 125 cm from the surface, 15 cm below the artefact bearing layer (white line). The bulk sediment sample weight is of 150.59 g.

Sample MAR01s2 is a 5 x10x 5 cm spit, taken at 112 cm from the surface, in the middle of a 40 cm artefact bearing layer (the white line). The bulk sediment sample weight is of 433.79 g.

Sample MAR01s3 is also a 5 x10x 5 cm spit, taken at 72 cm from the surface, 15 cm above the artefact bearing layer (white line). The bulk sediment sample weight is of 174.85 g.

The samples were collected in reverse order to retain integrity of the samples. The face of the excavation was cleaned at a horizontal depth of 1 cm to eliminate contamination from the above layers during the original mechanical excavation of the site.

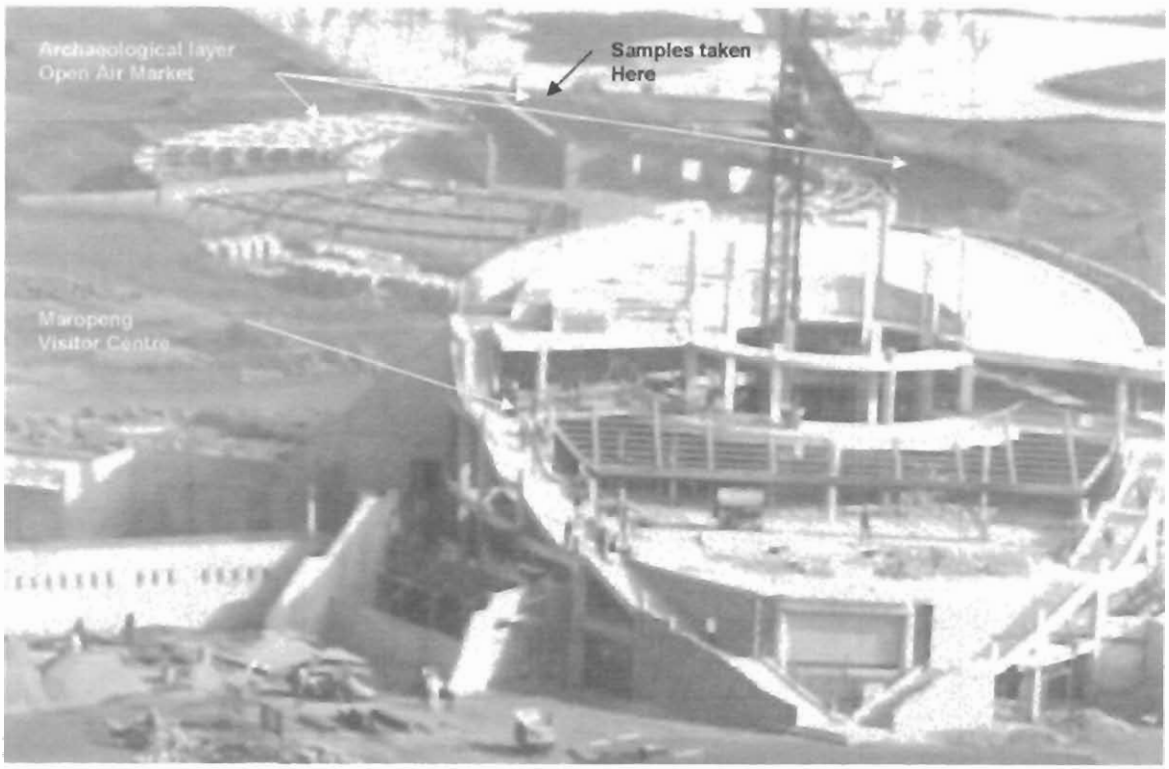

Figure 2. Location of the artefacts bearing deposit, and location of the samples taken for analysis.

The bulk samples were air dried in a laboratory, gently crushed to break up the soil and then dry sieved in 12 fractions (2000, 1400, 1000, 710, 500, 355, 250, 180, 125, 90, 63, and 0 microns). The weight of each fraction is then noted for grain size distribution (resulting data can be seen in Appendix A.) with the aid of GRADISTAT version 4, an analysis package for sample weight and size distribution.

The resulting data supports the visual observation that the top and the bottom sedimentary layers are of the same type deposits, which is also supported by the lack of colour differentiation between the two. The middle (artefact-bearing) layer is different, containing mainly unconsolidated quartz particles from fine gravel to clays of much different material when compared with the above and below sediment layers. Although, the GRADISTAT analysis is only considered for unconsolidated soils, and unsuited for the samples analysed, the results give an indication that the top and the bottom layers of red clay soils were deposited in

the same manner, with the same material. In contrast, the artefact bearing layer, 'sandwiched' between these, has a much larger content of rounded quartz gravel, probably derived from vein quartz from the above range. Further, evidence of haematitic pisiolites in the artefact-bearing layer may indicate a period of wet climate.

Chronology and archaeological potential:

Providing that sufficient quartz sand is found in all layers, depositional chronology can be achieved with the optically stimulated luminescence technique (OSL). Understanding the depositional chronology of these sediments may answer many questions in relation to climate, vegetation, environmental change, and considering the antiquity of the artefacts found in the layer, it would be advisable that a full archaeological excavation be undertaken. Also, it is advised (considering the site's use) that any excavation undertaken at the Maropeng visitor centre will be under public scrutiny, and an opportunity to make the excavation as a test for "open to the public archaeology" should also be considered

Bibliography

Blott, S.J. and Pye, K., 2001. GRADISTAT: A grain size distribution and statistics package for the analysis of unconsolidated sediments. Earth Surface Processes and Landforms, 26: 1237–1248.

Appendix A.

Granulometry statistics for the three samples of sediment taken

SIEVING Error	**2.7%**		SAMPLE STATISTICS			
SAMPLE IDENTITY:	**MAR-01s1**		ANALYST & DATE: G. Susino, 07-10-2005			
SAMPLE TYPE:	Unimodal, Poorly Sorted		TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME:	Sandy Very Fine Gravel					
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2400.0	-1.243	GRAVEL:	32.0%	COARSE SAND:	15.6%
MODE 2:			SAND:	65.5%	MEDIUM SAND:	10.4%
MODE 3:			MUD:	2.4%	FINE SAND:	7.7%
D_{10}	152.3	-1.334			V FINE SAND:	5.4%
MEDIAN or D_{50}	1286.1	-0.363	V COARSE GRAVEL:	0.0%	V COARSE SILT:	0.4%
D_{90}	2520.8	2.715	COARSE GRAVEL:	0.0%	COARSE SILT:	0.4%
(D_{90} / D_{10})	16.55	-2.035	MEDIUM GRAVEL:	0.0%	MEDIUM SILT:	0.4%
(D_{90} - D_{10})	2368.6	4.049	FINE GRAVEL:	0.0%	FINE SILT:	0.4%
(D_{75} / D_{25})	4.567	-0.980	V FINE GRAVEL:	32.0%	V FINE SILT:	0.4%
(D_{75} - D_{25})	1681.9	2.191	V COARSE SAND:	26.4%	CLAY:	0.4%

	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
$(\bar{X})$ MEAN:	1335.3	847.2	0.239	922.7	0.116	Coarse Sand
SORTING (σ):	876.0	3.408	1.769	2.891	1.532	Poorly Sorted
SKEWNESS (Sk):	-0.020	-1.679	1.679	-0.508	0.508	Very Fine Skewed
KURTOSIS (K):	1.472	6.227	6.227	0.904	0.904	Mesokurtic

SIEVING ERROR:	0.5%		**SAMPLE STATISTICS**			
SAMPLE IDENTITY:	**MAR-01s2**		ANALYST & DATE: G. Susino, 07-10-2005			
SAMPLE TYPE:	Unimodal, Moderately Well Sorted		TEXTURAL GROUP: Gravel			
SEDIMENT NAME:	Very Fine Gravel					
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2400.0	-1.243	GRAVEL:	88.8%	COARSE SAND:	1.5%
MODE 2:			SAND:	10.5%	MEDIUM SAND:	1.5%
MODE 3:			MUD:	0.7%	FINE SAND:	2.0%
D_{10}	1659.9	-1.431			V FINE SAND:	2.4%
MEDIAN or D_{50}	2316.9	-1.212	V COARSE GRAVEL:	0.0%	V COARSE SILT:	0.1%
D_{90}	2695.9	-0.731	COARSE GRAVEL:	0.0%	COARSE SILT:	0.1%
(D_{90} / D_{10})	1.624	0.511	MEDIUM GRAVEL:	0.0%	MEDIUM SILT:	0.1%
(D_{90} - D_{10})	1036.1	0.700	FINE GRAVEL:	0.0%	FINE SILT:	0.1%
(D_{75} / D_{25})	1.209	0.797	V FINE GRAVEL:	88.8%	V FINE SILT:	0.1%
(D_{75} - D_{25})	439.5	0.273	V COARSE SAND:	3.2%	CLAY:	0.1%

	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	μm	μm	ϕ	
$(\bar{X})$ MEAN:	2203.9	1887.1	-0.916	2316.9	-1.212	Very Fine Gravel
SORTING (σ):	591.0	2.215	1.147	1.532	0.615	Moderately Well Sorted
SKEWNESS (Sk):	-2.906	-4.175	4.175	-0.429	0.429	Very Fine Skewed
KURTOSIS (K):	9.856	22.04	22.04	5.171	5.171	Extremely Leptokurtic

SIEVING ERROR:	2.1%		**SAMPLE STATISTICS**			
SAMPLE IDENTITY:	**MAR-01s3**		ANALYST & DATE: G. Susino, 07-10-2005			
SAMPLE TYPE:	Unimodal, Poorly Sorted		TEXTURAL GROUP: Sandy Gravel			
SEDIMENT NAME:	Sandy Very Fine Gravel					
	μm	ϕ	GRAIN SIZE DISTRIBUTION			
MODE 1:	2400.0	-1.243	GRAVEL:	41.4%	COARSE SAND:	13.4%
MODE 2:			SAND:	56.6%	MEDIUM SAND:	9.3%
MODE 3:			MUD:	2.0%	FINE SAND:	6.4%
D_{10}:	165.1	-1.368			V FINE SAND:	5.1%
MEDIAN or D_{50}:	1585.3	-0.665	V COARSE GRAVEL:	0.0%	V COARSE SILT:	0.3%
D_{90}:	2581.4	2.599	COARSE GRAVEL:	0.0%	COARSE SILT:	0.3%
(D_{90} / D_{10}):	15.64	-1.899	MEDIUM GRAVEL:	0.0%	MEDIUM SILT:	0.3%
(D_{90} - D_{10}):	2416.4	3.967	FINE GRAVEL:	0.0%	FINE SILT:	0.3%
(D_{75} / D_{25}):	4.043	-0.690	V FINE GRAVEL:	41.4%	V FINE SILT:	0.3%
(D_{75} - D_{25}):	1719.9	2.015	V COARSE SAND:	22.4%	CLAY:	0.3%

	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic	Geometric	Logarithmic	Geometric	Logarithmic	Description
	μm	μm	ϕ	μm	ϕ	
$(\bar{X})$ MEAN:	1478.5	968.1	0.047	1059.4	-0.083	Very Coarse Sand
SORTING (σ):	896.4	3.311	1.727	2.779	1.474	Poorly Sorted
SKEWNESS (Sk):	-0.279	-1.795	1.795	-0.630	0.630	Very Fine Skewed
KURTOSIS (K):	1.471	6.610	6.610	0.969	0.969	Mesokurtic

All the statistics are derived from the GRADISTAT program (Blott and Pye, 2001).