

TEMA 2. QUÈ SÓN ELS NÚMEROS?

Hill of Tara, Irlanda

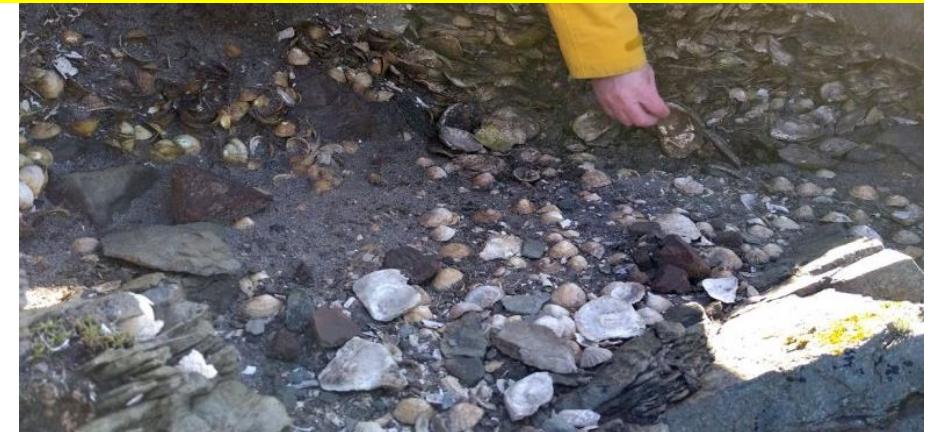
Juan A. Barceló
Olga Palacios

Els números són descripcions

Com podríem descriure el conquiller? Quines característiques podríem definir?



Knap of Howar, Orkney Islands, UK



Els números són descripcions i, per tant, és molt important saber què estem descrivint

Quin sentit té descriure el conquiller proper al jaciment? Què volem conèixer?



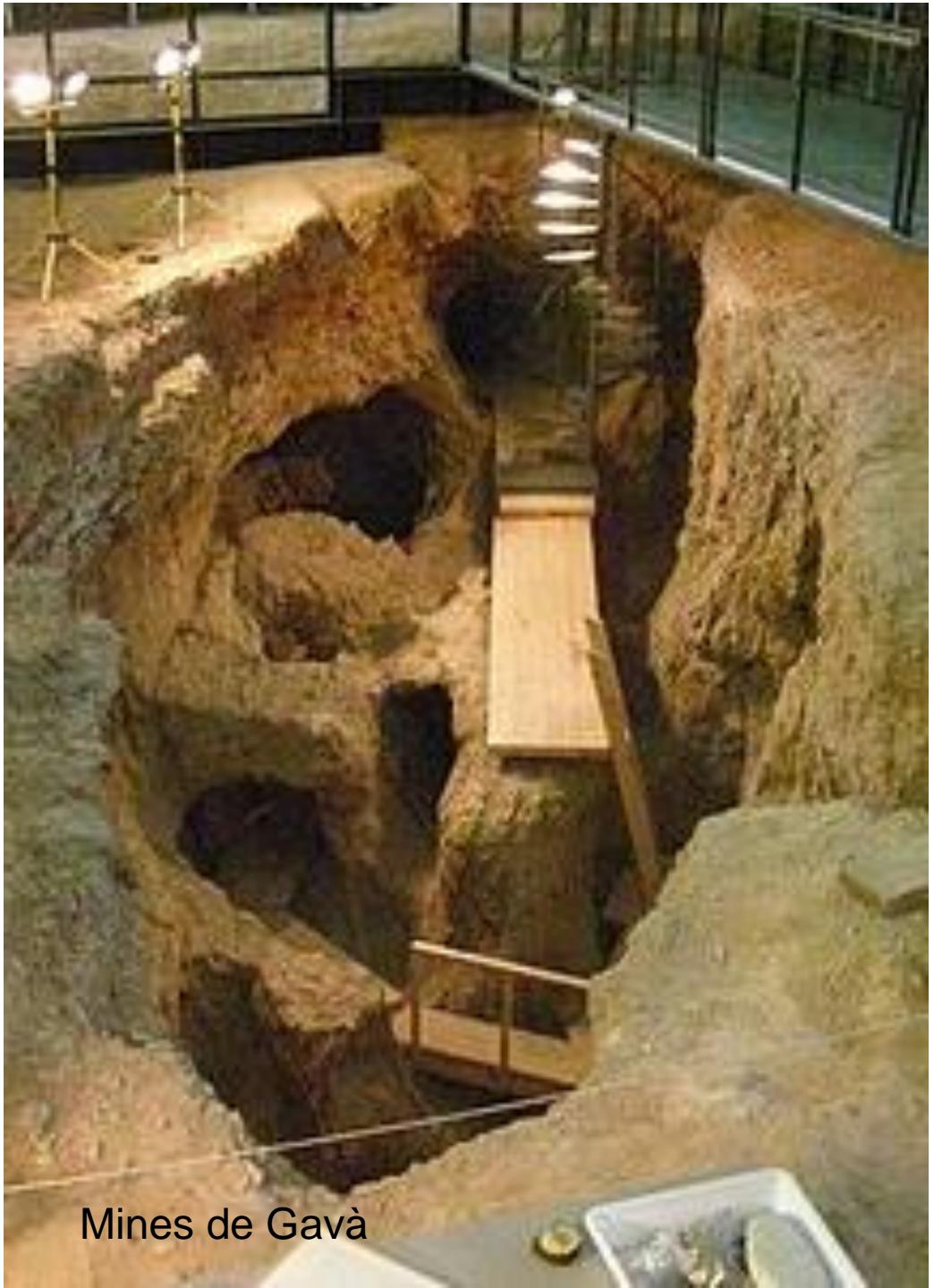
Knap of Howar, Orkney Islands, UK





QUANTITAT O QUALITAT?

Knap of Howar, Orkney Islands, UK



Mines de Gavà

QUANTITAT O QUALITAT?

- **Quantitat:** propietat de les entitats que permet una gradació i, per tant, podem ordenar.
- **Qualitat:** no admet graus, no generen ordenacions i són subjectives.



Knap of Howar, Orkney Islands, UK

QUANTITAT O QUALITAT?

- **Quantitat:** propietat de les entitats que permet una gradació i, per tant, podem ordenar.

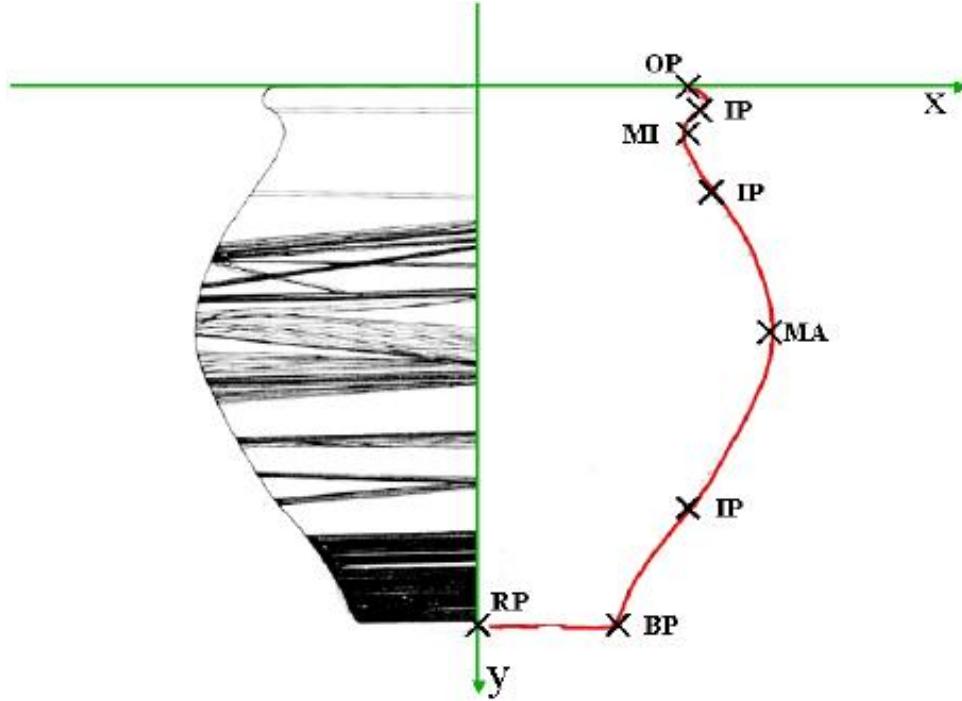
Necessitem **MESURAR**: és l'operació d'assignar números que representen el grau en que un objecte o fenomen té la propietat quantitativa que volem conèixer

INSTRUMENTS DE MESURA

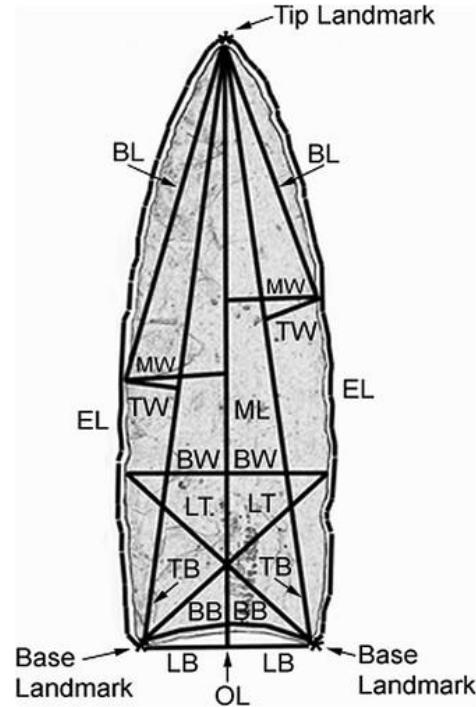
Aparells, tècniques o operadors lògics que implementen l'ordenació considerada de referència

Els problemes de les Ciències Socials és que no sempre podem mesurar amb els Instruments de Mesura, però sí que podem convertir les ordenacions en funcions matemàtiques i utilitzar-les d'instrument

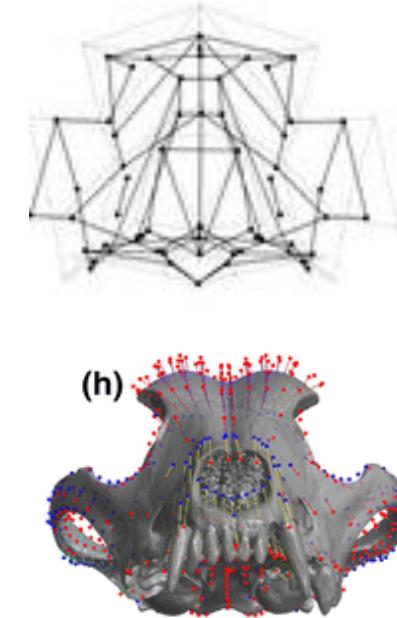
Els ARTEFACTES es descriuen quantitativament



Adler et al. (2002). Computer Aided Classification of Ceramics: Achievements and Problems



O'Brien et al. (2012). Cultural Cladistics and the Early Prehistory of North America.

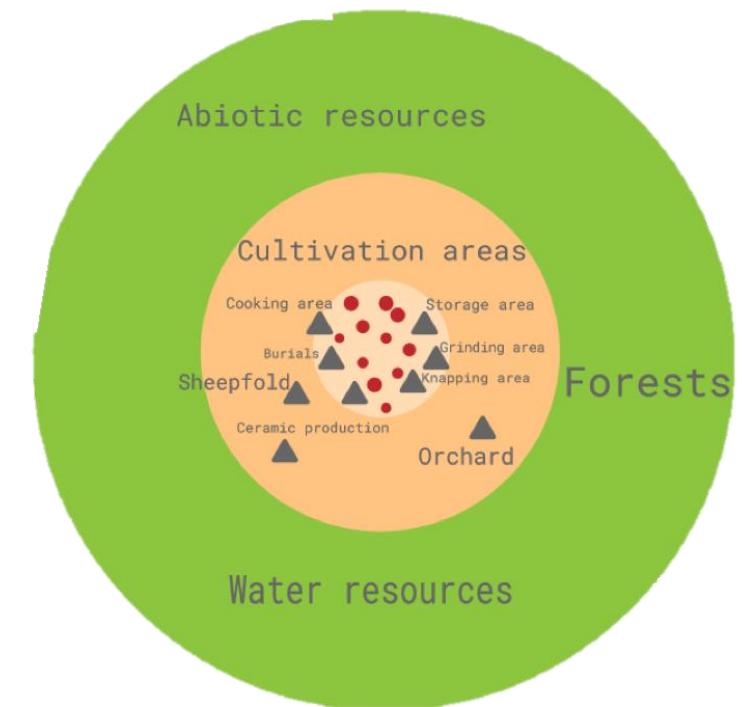


Parr et al. (2016). Cranial Shape and the Modularity of Hybridization in Dingoes and Dogs; Hybridization Does Not Spell the End for Native Morphology

Les ÀREES D'ACTIVITAT es descriuen quantitativa o qualitativament

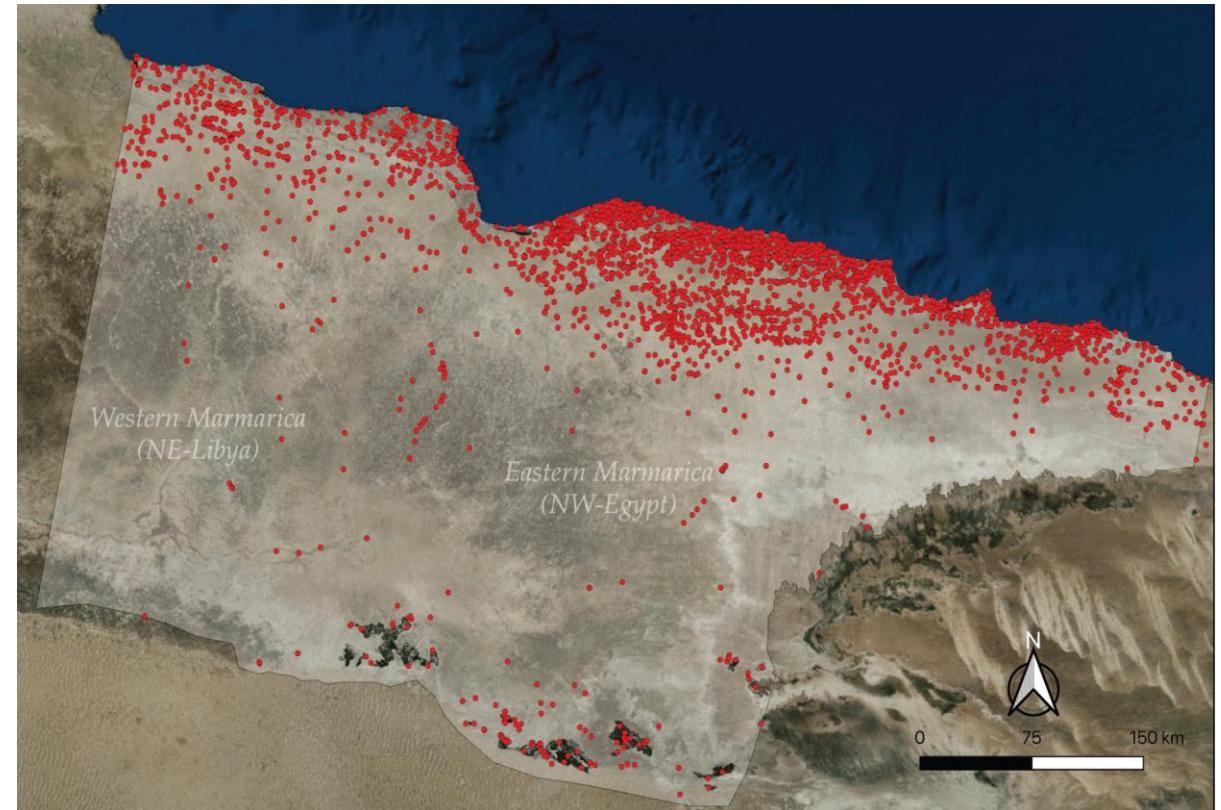
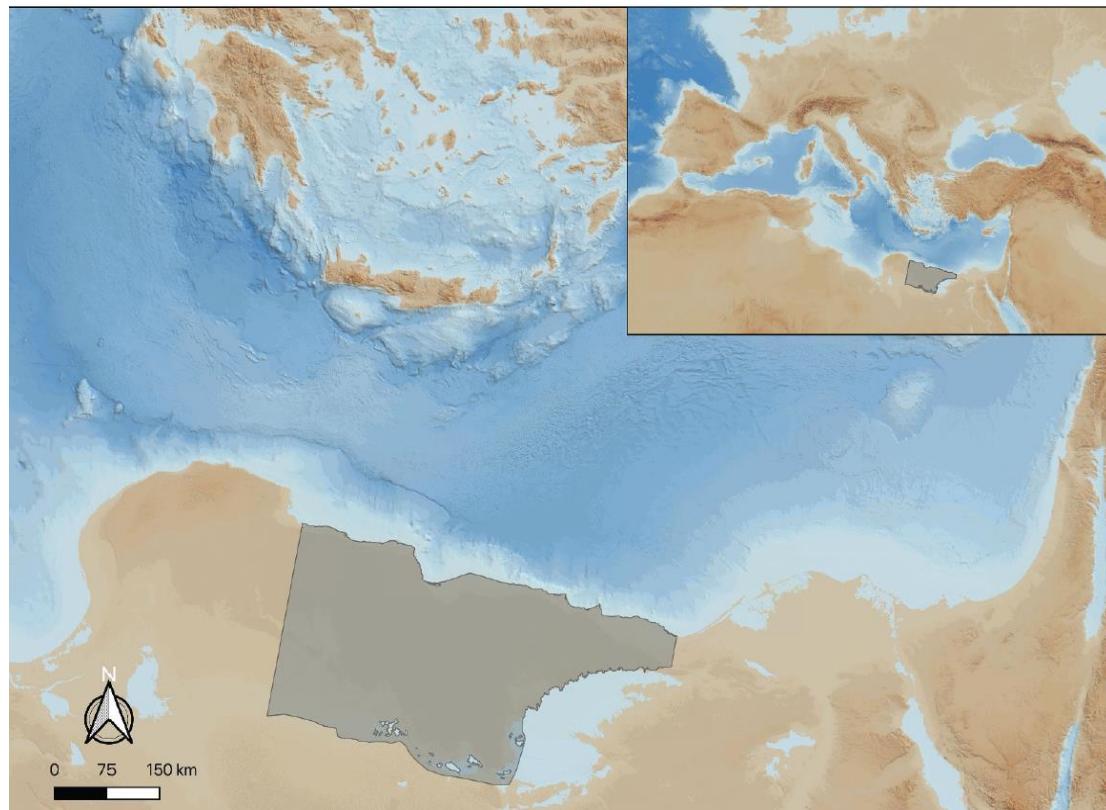


Knap of Howar, Orkney Islands, UK



Adapted from Maestre et al., 2019: 36

EI PAISATGE i el TERRITORI es descriuen quantitativa o qualitativament



Laguna-Palma et al. (2024). Assessing the risks of northeastern African archaeological heritage and their relationship to human–environmental processes: a Bayesian network approach. <https://doi.org/10.1080/00438243.2024.2382138>

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

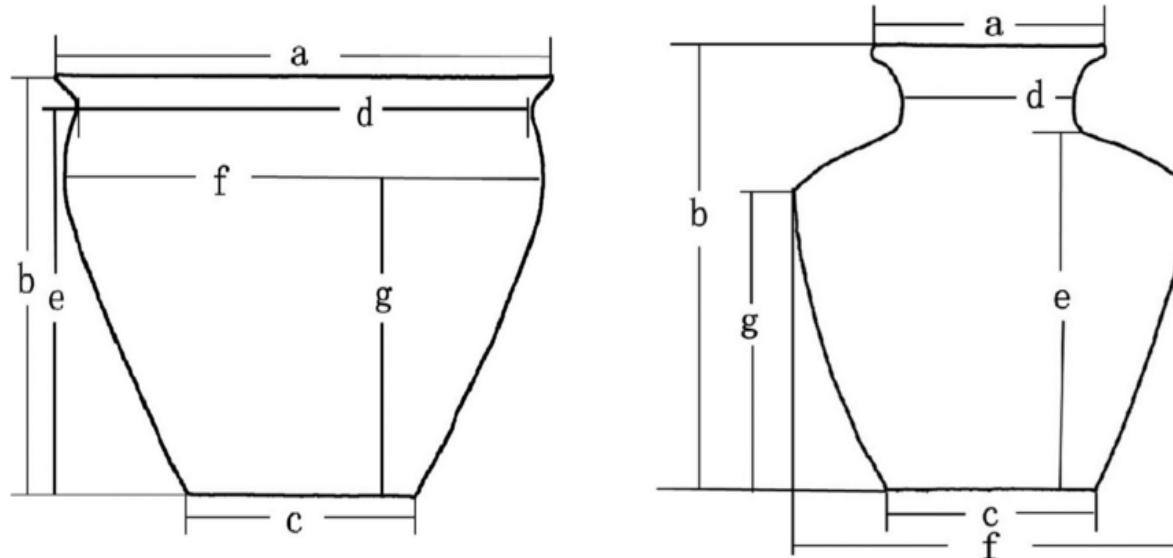
1. Grandària (“tamaño”)
2. Forma
3. Textura
4. Materialitat
 - 4.1. Composició
 - 4.2. Propietats físiques i mecàniques
5. Ubicació
 - 5.1. Espai
 - 5.2. Temps



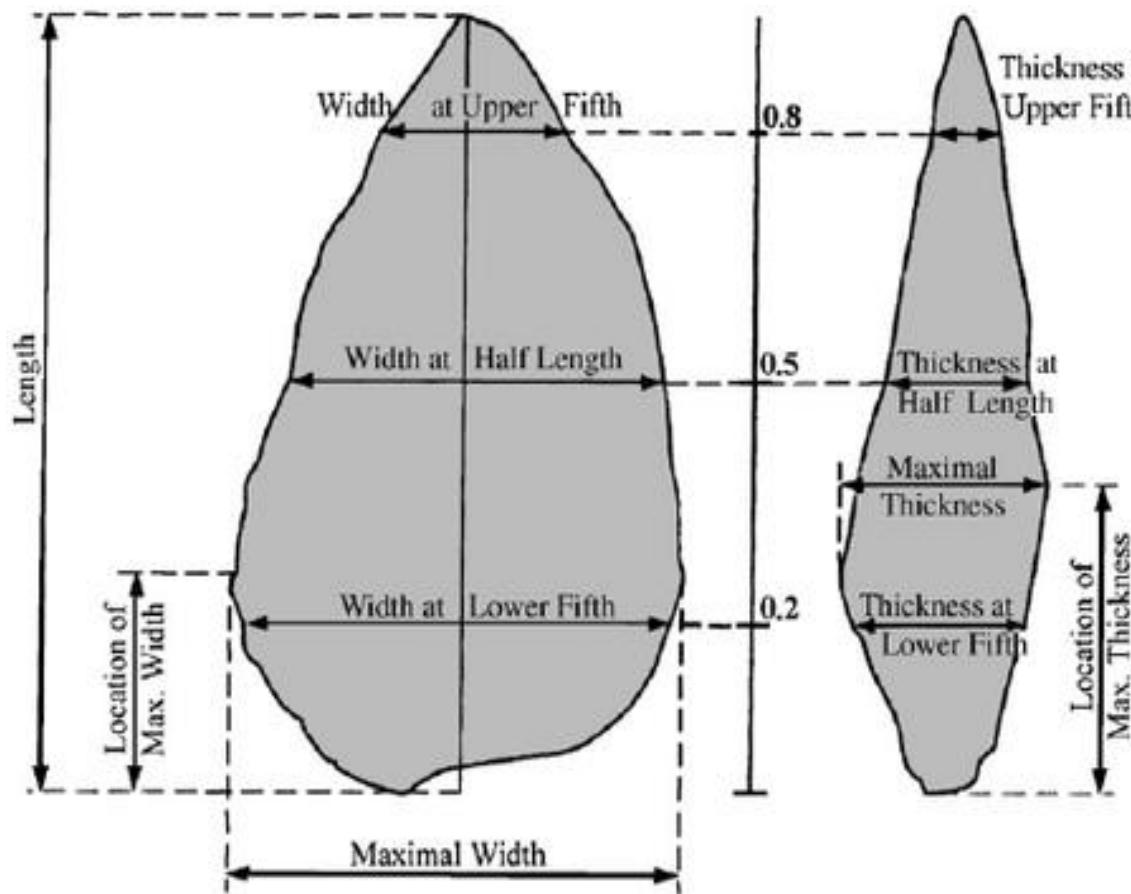
MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

1. GRANDÀRIA

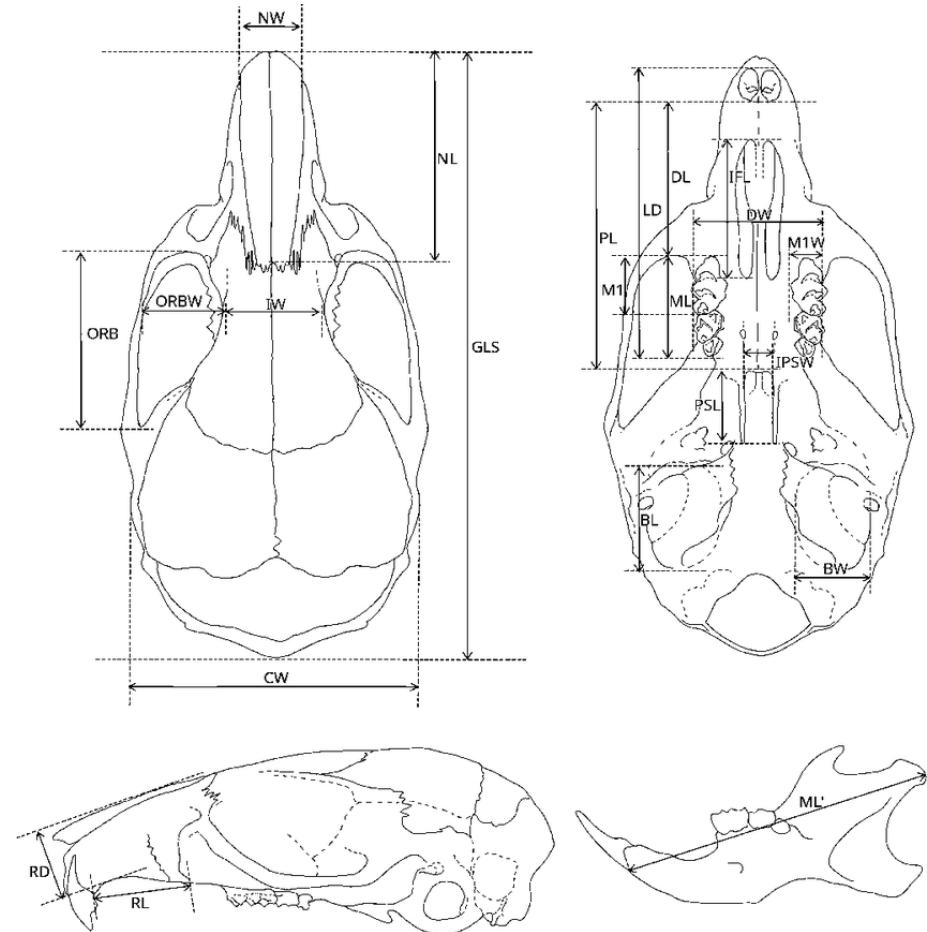
- Longitud
- Alçada
- Diàmetre
- Volum



Wang et al. (2019). Quantitative analysis of pottery from the Tianma-Qucun site based on 3D scanning and computer technology. Archaeological and Anthropological Sciences 11(3).



Sharon (2008). The impact of raw material on Acheulian large flake production. Journal of Archaeological Science 35(5):1329-1344



Suzuki (2021). Morphological and Molecular Recharacterization of the Rodent Genus *Mus* from Nepal Based on Museum Specimens. Mammal Study 46(4)



Westcombe Park, UK

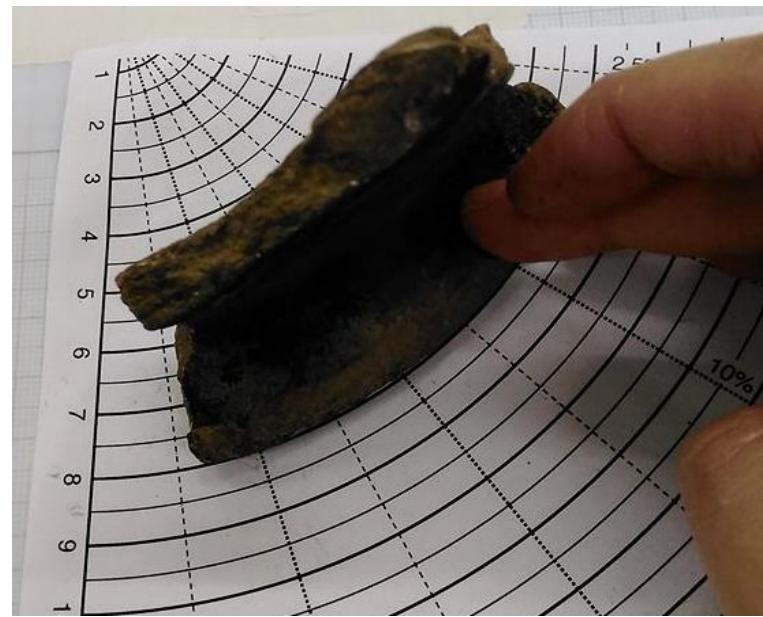


UCD Experimental Centre, Ireland

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

1. GRANDÀRIA

- Longitud
- Alçada
- **Diàmetre**
- Volum



MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

1. GRANDÀRIA

- Longitud
- Alçada
- Diàmetre
- **Volum**

<https://kotyle.readthedocs.io/en/latest/>



Àmfora romana,
32 litres aproximadament

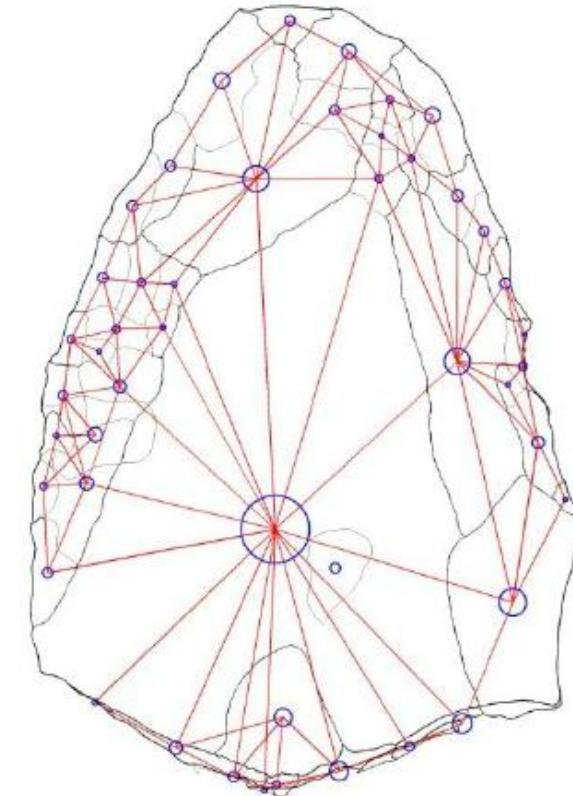


Àmfora egípcia,
27 litres aproximadament

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

2. FORMA

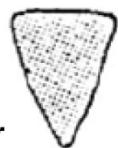
- Propietats d'una configuració de punts invariants a la grandària, a la ubicació o al punt de vista de l'observador
- Ens permet identificar la 'unicitat' de l'entitat en l'espai i respecte altres entitats



Richardson et al. (2013). Extracting Scar and Ridge Features from 3D-scanned Lithic Artifacts. In Archaeology in the Digital Era, Amsterdam University Press

Para su **descripción** tenemos en cuenta los siguientes parámetros:

- **Forma de la pieza** (en visión frontal):



Triangular

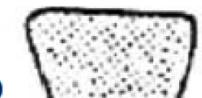


; rectangular



; trapezoidal

- **Filo** (en visión frontal):



Rectilíneo



; curvo

- **Perfil del filo:**



Simétrico



; asimétrico

- **Base** (en visión frontal):

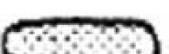


Redondeada



; recta

- **Sección:**



Rectangular



; en media luna



; oval

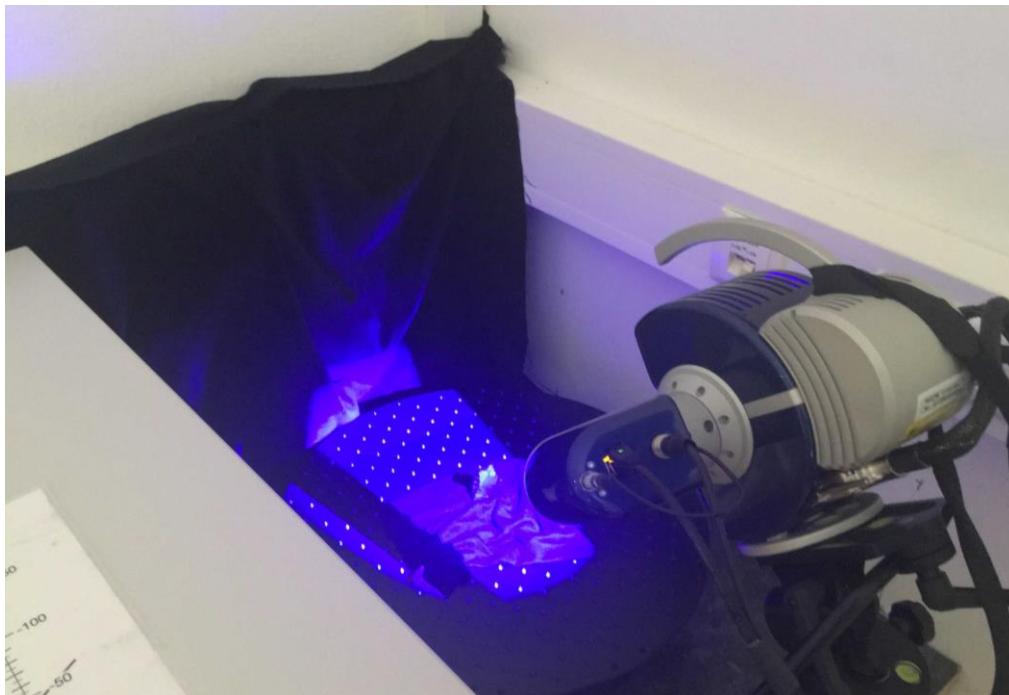


; circular

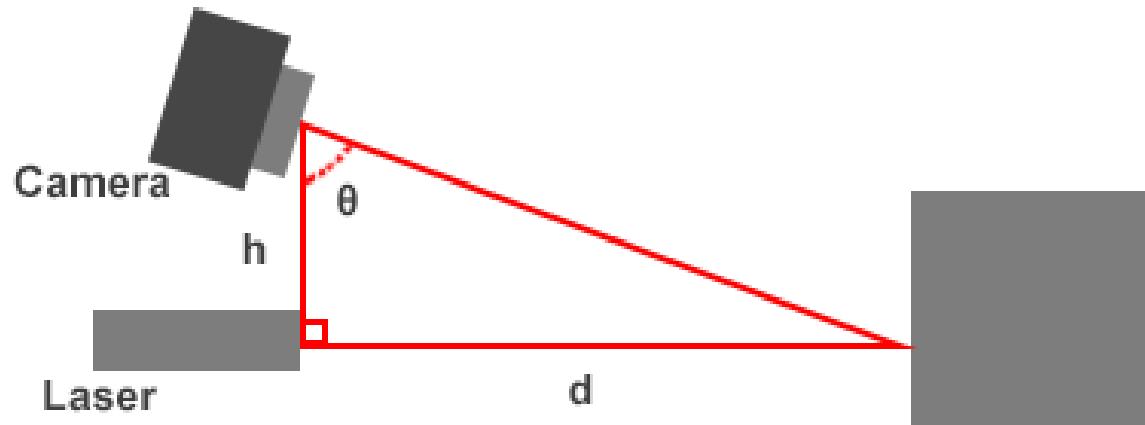
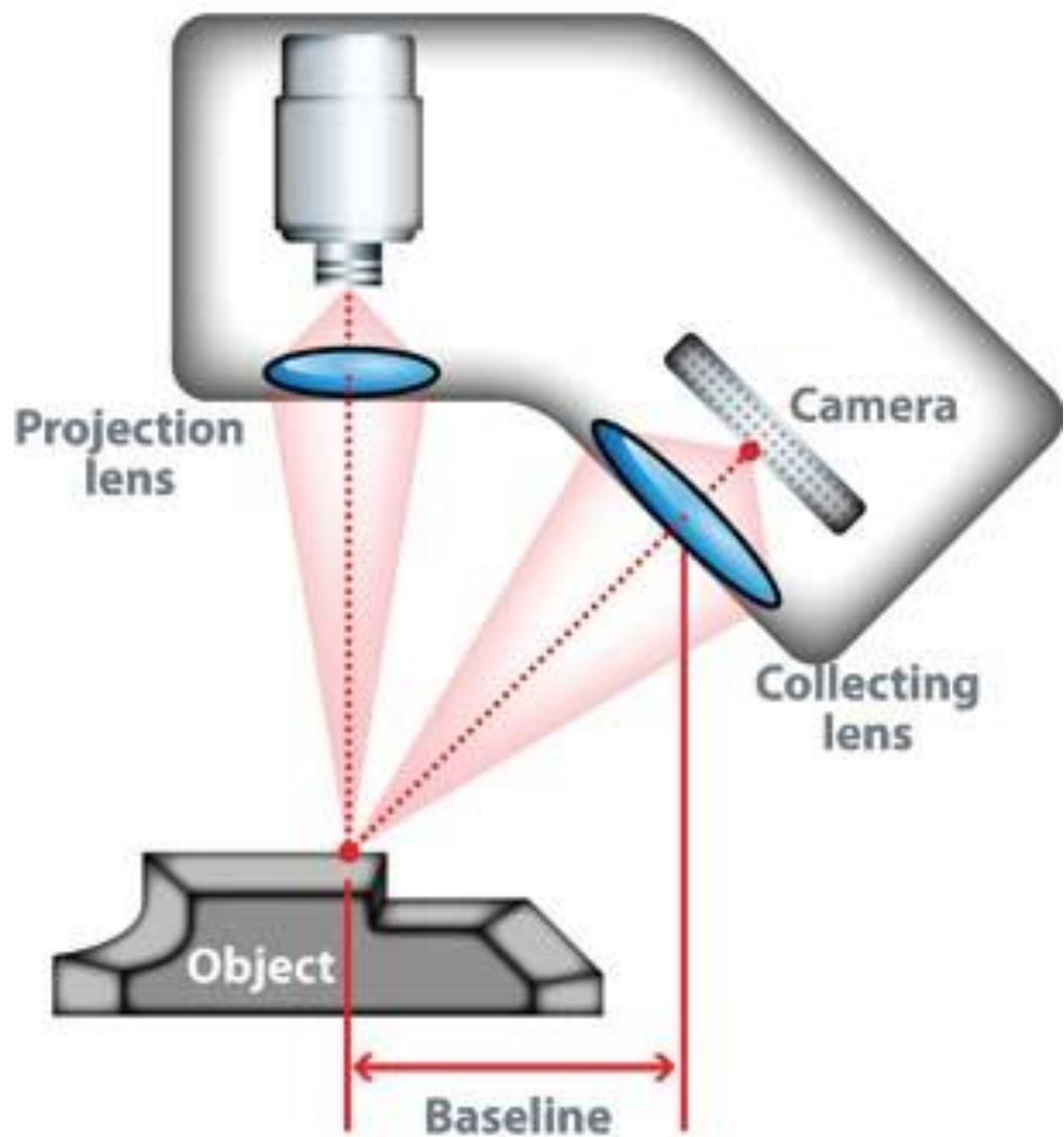


Com podem establir les quantitats més sistemàticament?

3D SCANNING



Laser source



h = distance between camera and laser (known)

θ = angle between laser and scanner (known)

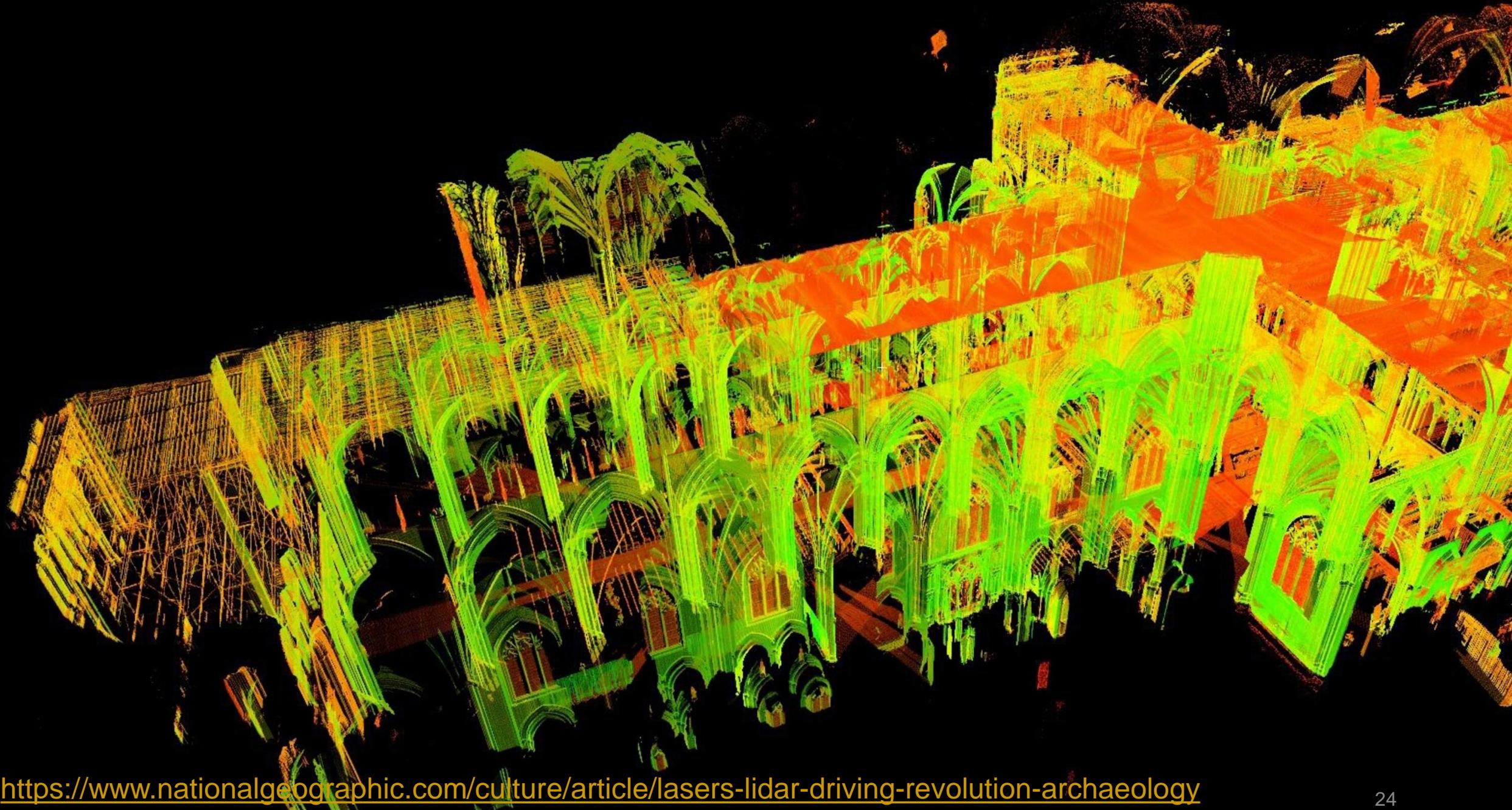
d = distance between scanner and object (unknown)

$$d = h * \tan(\theta)$$



PHOTOGRAMMETRY

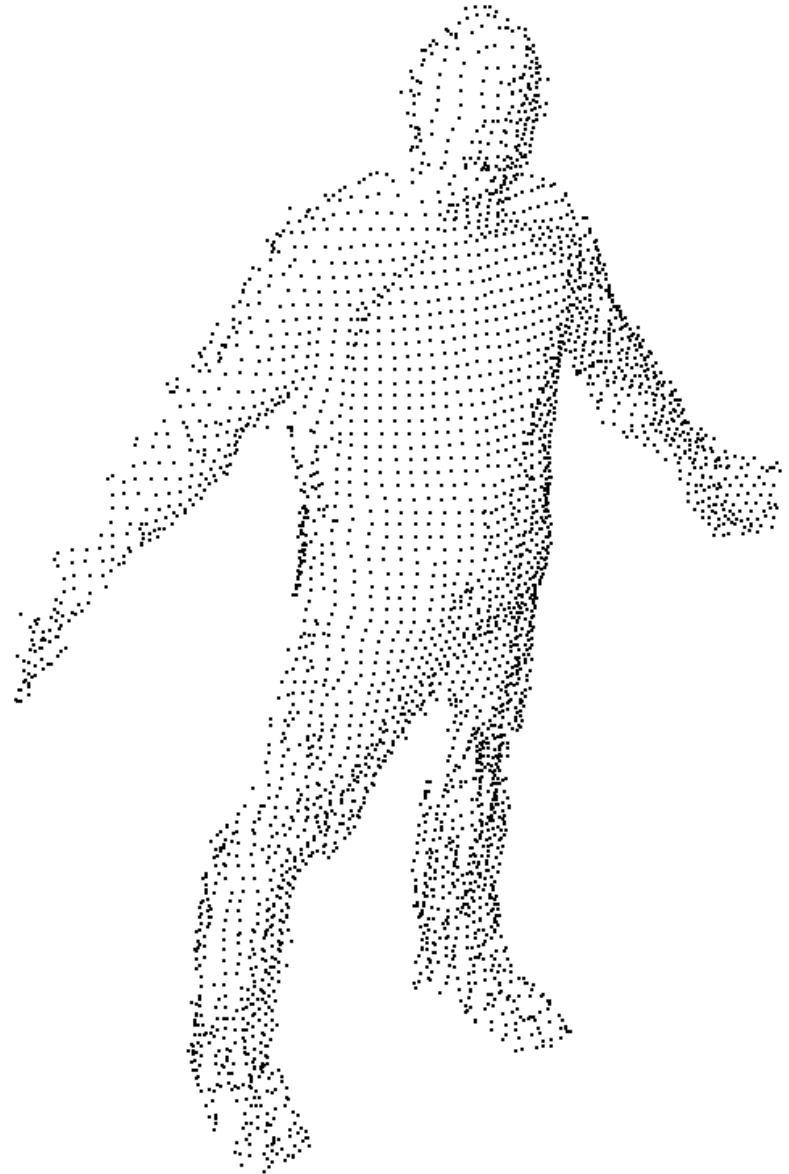




<https://www.nationalgeographic.com/culture/article/lasers-lidar-driving-revolution-archaeology>

Diferències entre escàner 3D i fotogrametria

	Escàner 3D	Fotogrametria
Avantatges	<ul style="list-style-type: none">PrecisióAlta resolucióMida reduïda	<ul style="list-style-type: none">Color i texturaPreu
Desavantatges	<ul style="list-style-type: none">Cal un medi controlatNo tots color i texturaPreu	<ul style="list-style-type: none">Temps (100 fotos aprox.)Problemes amb color i textura (llis, mateix color)Precisió i resolució



X	Y	Z
1	1	3
4	3	6
7	6	14

X1	X2	X3	X4
Y1			
Y2			
Y3			

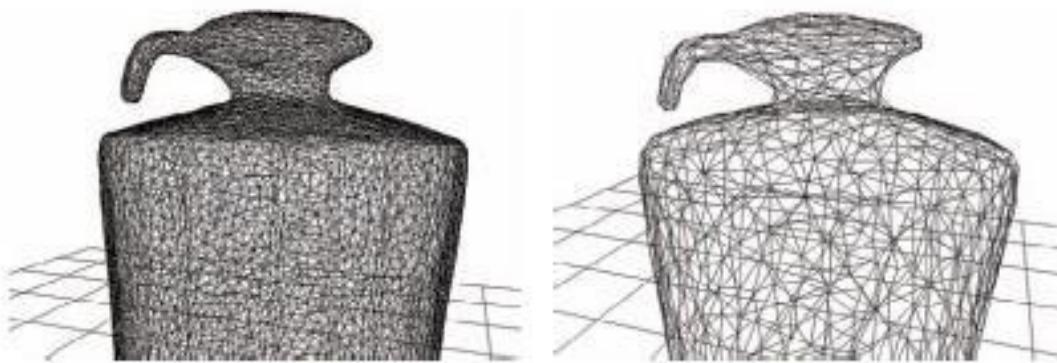


Figura 2.29 Malha poligonal com 10.000 (esq.) e 1.250 (dir.) polígonos [Moitinho07b, c].

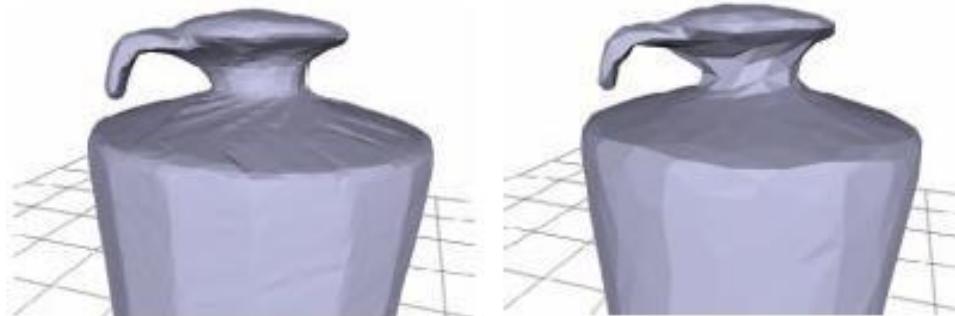


Figura 2.30 *Flat shading* aplicada a malha poligonal com 10.000 (esq.) e 1.250 (dir.) polígonos [Moitinho07b, c].

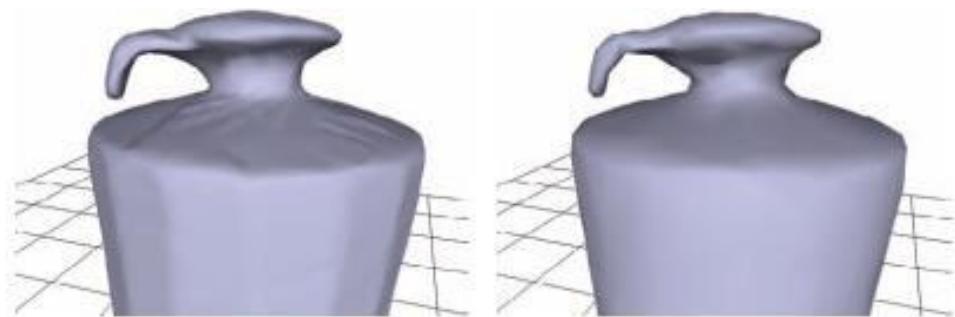


Figura 2.31 *Smooth shading* aplicada a malha poligonal com 10.000 (esq.) e 1.250 (dir.) polígonos [Moitinho07b, c].

3D File Format

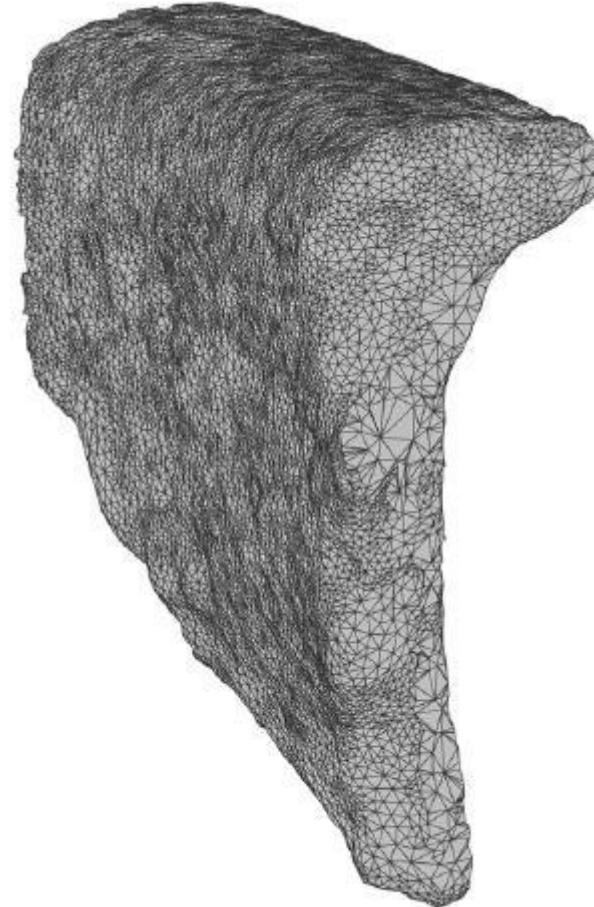
facet normal n_i

n_j n_k
outer loop

vertex $v1_x$ $v1_y$
 $v1_z$ vertex $v2_x$
 $v2_y$ $v2_z$ vertex
 $v3_x$ $v3_y$ $v3_z$

endloop

endfacet

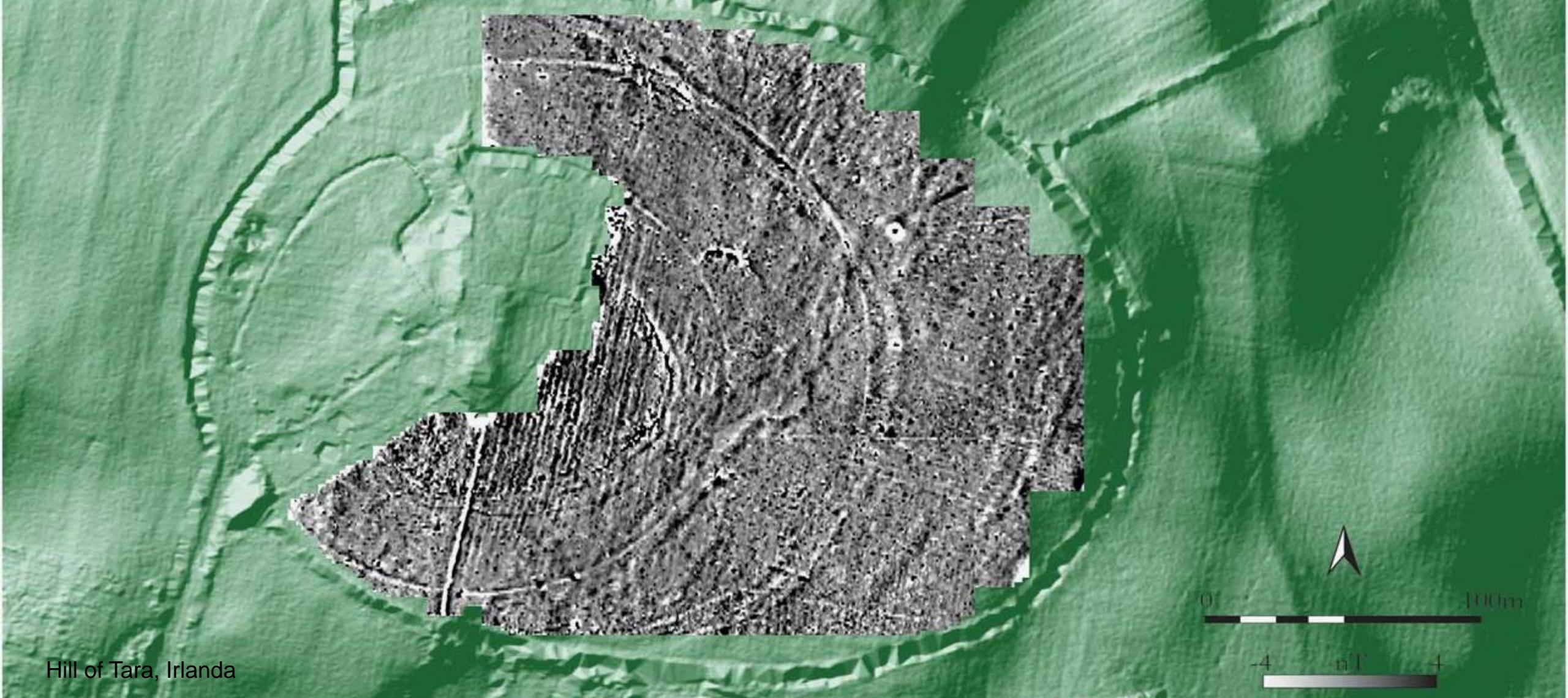


TOPOGRAFIA, quin mètode?



Hill of Tara, Irlanda





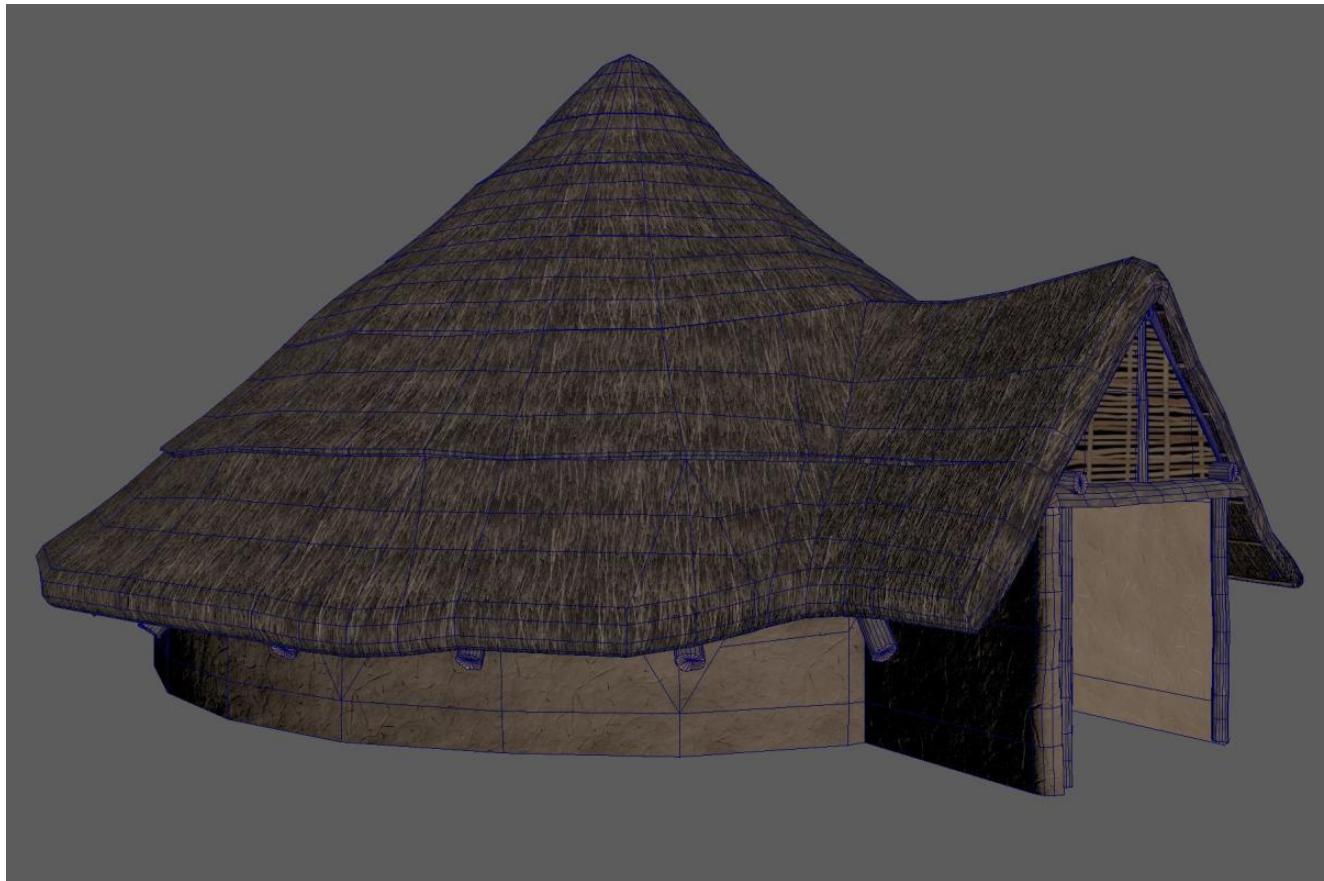
Hill of Tara, Irlanda

- SKETCHFAB: https://sketchfab.com/3d-models/categories/cultural-heritage-history?date=week&sort_by=-likeCount

Quin mètode?

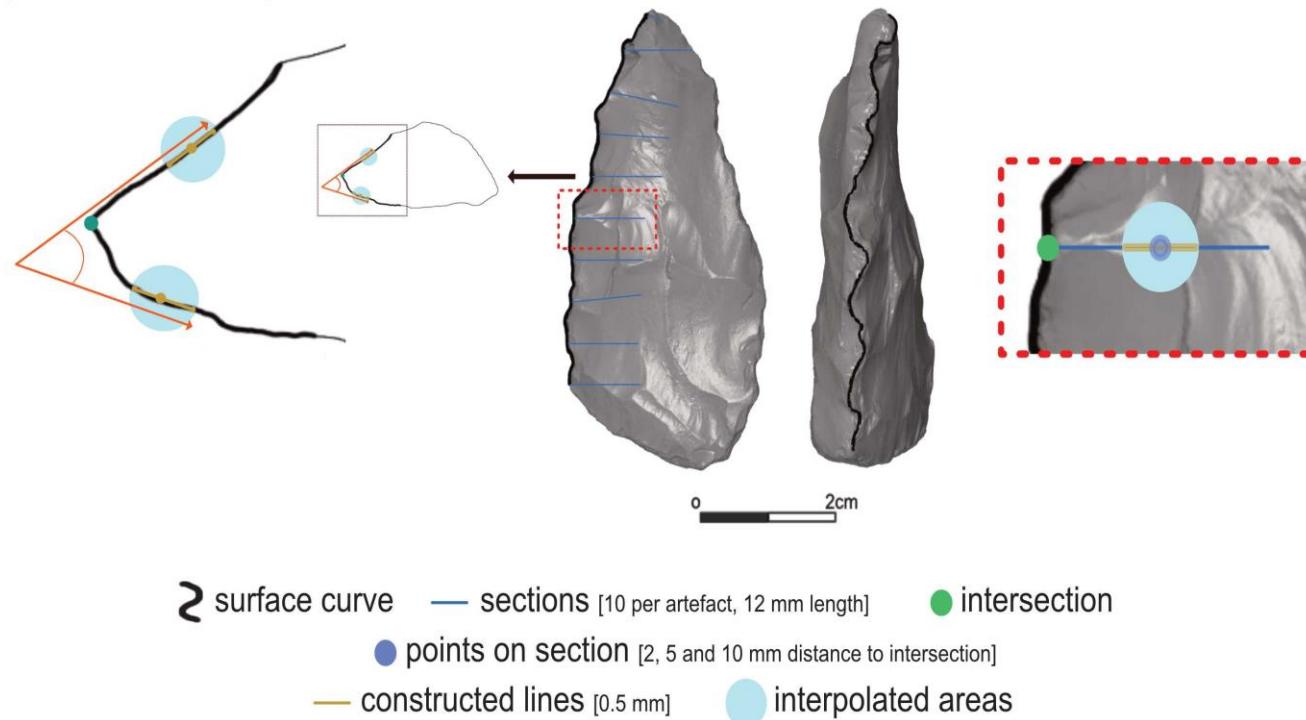


Venus de Gavà



Roundhouse Wessex, UK

Ens permet quantificar característiques que abans eren difícils de mesurar



Schunk et al. (2023). Enhancing lithic analysis: Introducing 3D-EdgeAngle as a semi-automated 3D digital method to systematically quantify stone tool edge angle and design

INTERROGANT A UN MODEL GEOMÉTRIC

Circularity: the degree of circularity of a texel. That is how much this texel is similar to a circle. Where 1 is a perfect circle and 0.492 is an isosceles triangle. This shape is expressed by:

$$\frac{4\pi s}{p^2}$$

s: texel area
p: texel perimeter

Quadrature: the degree of quadrature of a texel, where 1 is a square and 0.800 an isosceles triangle. This shape is expressed by:

$$\frac{p}{4\sqrt{s}}$$

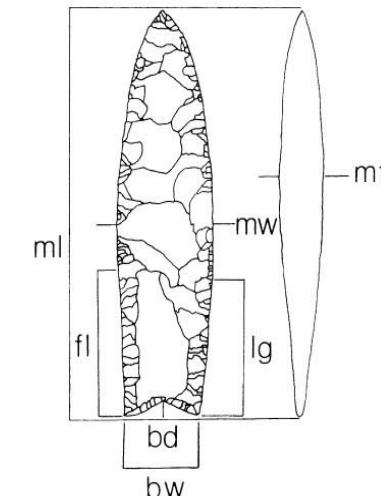
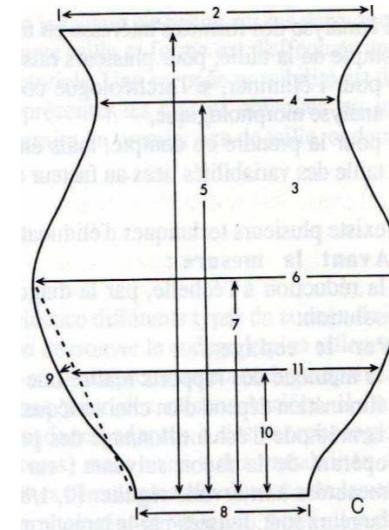
Irregularity: measurement of the irregularity of a texel, done with its perimeter and the perimeter of the surrounding circle. The minimum irregularity is a circle, corresponding at the value 1. A square is the maximum irregularity with a value of 1.402. This shape is expressed by:

$$\frac{p_c}{p}$$

Elongation: as the degree of ellipticity of a texel. Where a circle and a square are the less elliptic shape. This shape is expressed by:

$$\frac{D}{d}$$

D: maximum diameter within a texel
d: minimum diameter perpendicular at D



Paràmetres de “Forma”

Form factor: $4\pi \cdot \text{area} / \sqrt{\text{perimeter}}$

Roundness: $4 \cdot \text{area} / \pi \cdot \sqrt{\text{major axis}}$

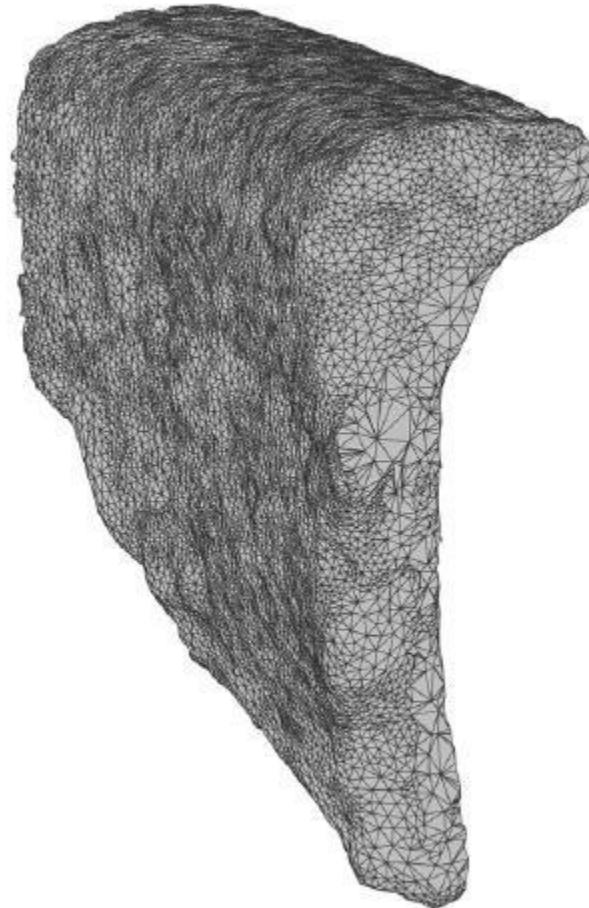
Compactness: $\sqrt{(4/\pi) \cdot \text{area}} / \text{major axis}$

Aspect ratio: major axis/minor axis

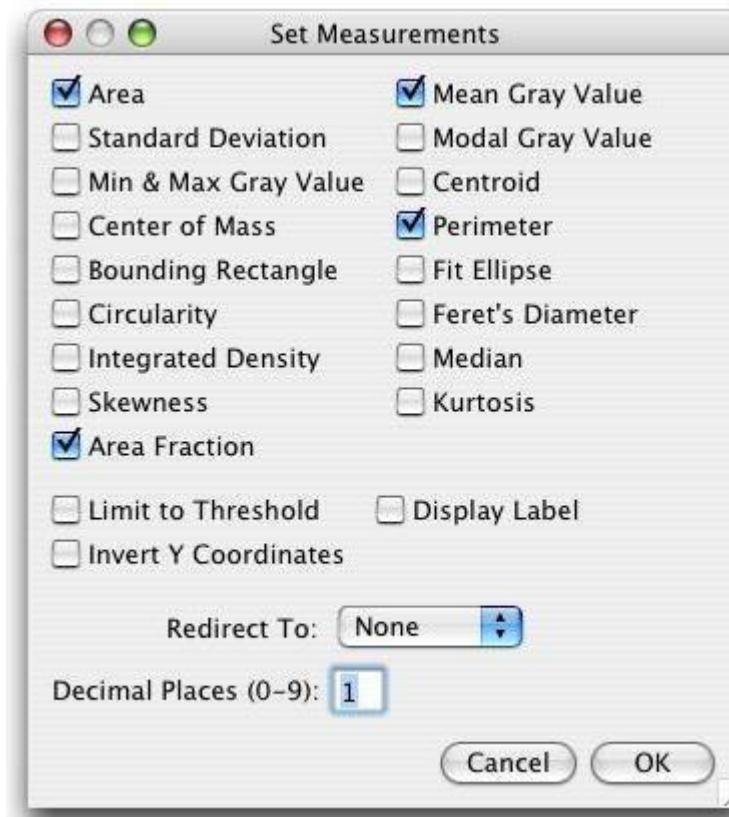
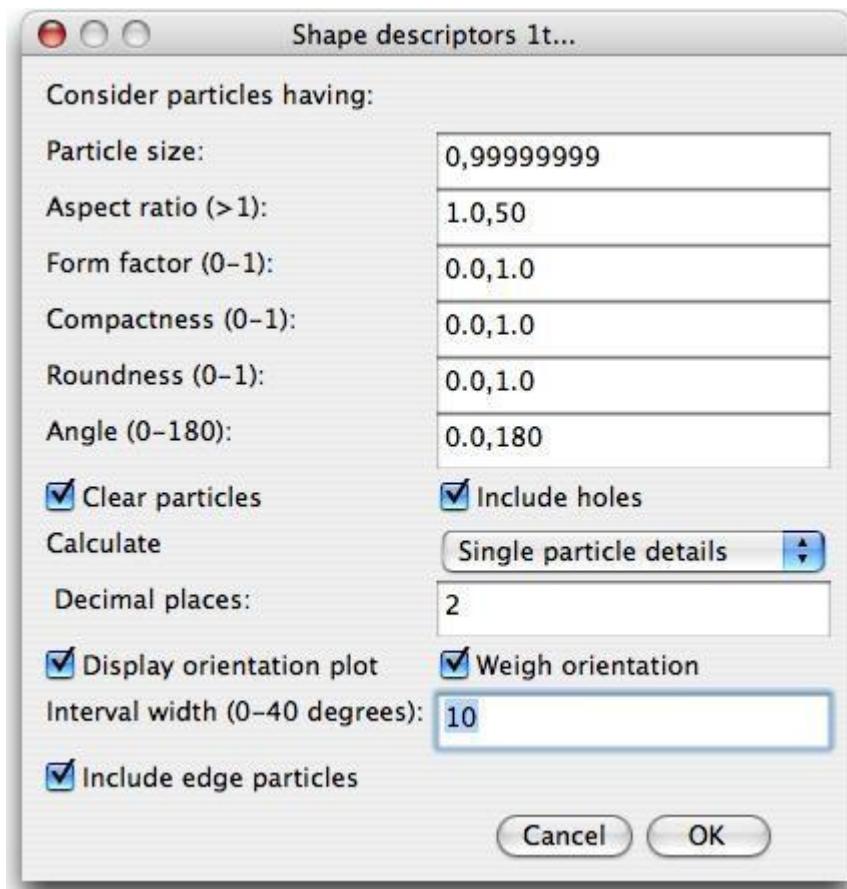
Effective diameter: $\sqrt{\text{area}/\pi} \cdot 2$

Solidity: area/ convex area

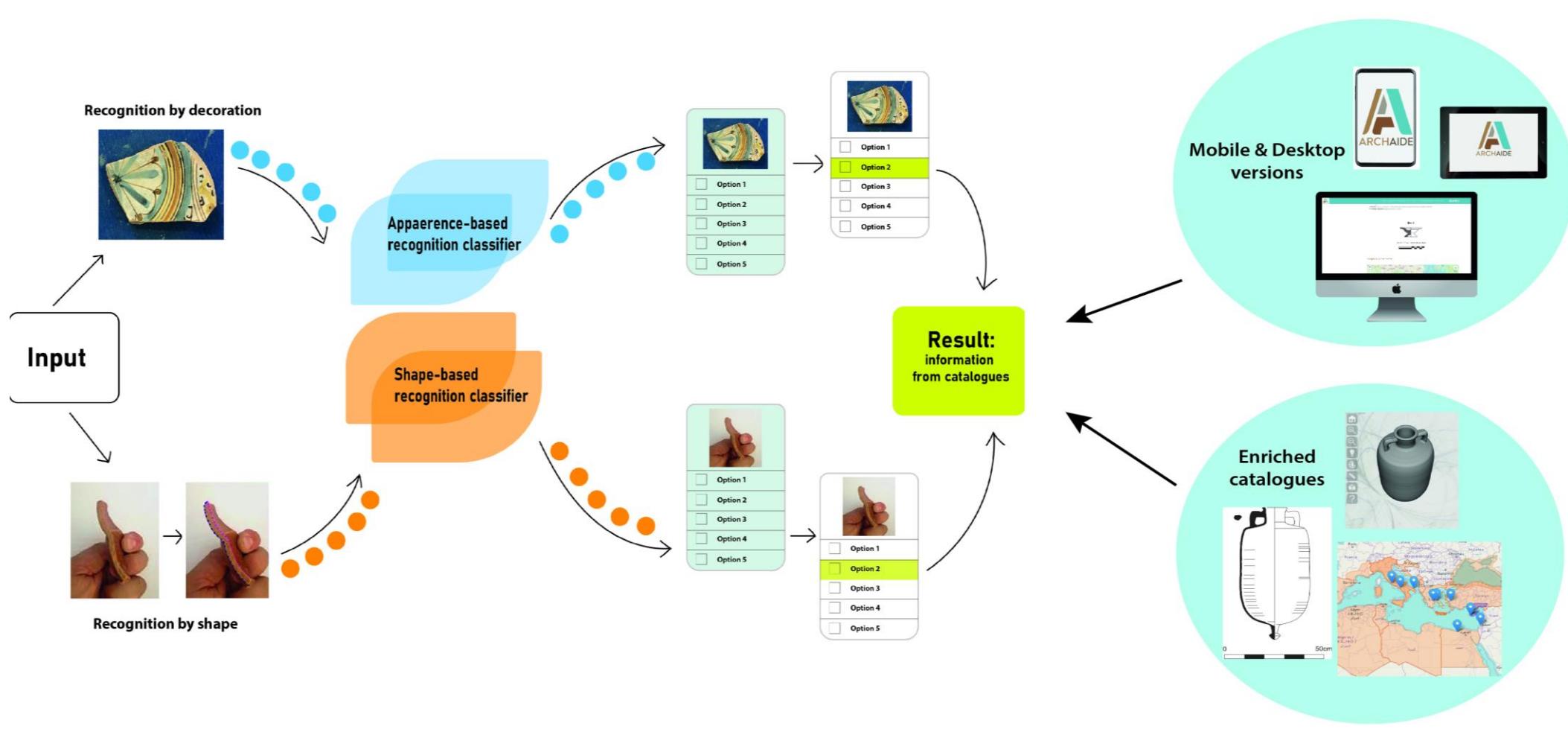
Convexity: convex perimeter/perimeter



ImageJ. <http://rsb.info.nih.gov/ij/> Fiji is Just ImageJ. <http://fiji.sc/Fiji>



Podem fer classificacions automàticament



Gualandi et al. (2021). An Open System for Collection and Automatic Recognition of Pottery through Neural Network Algorithms. *Heritage*, 4(1), 140–159; <https://doi.org/10.3390/heritage4010008>

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

3. TEXTURA

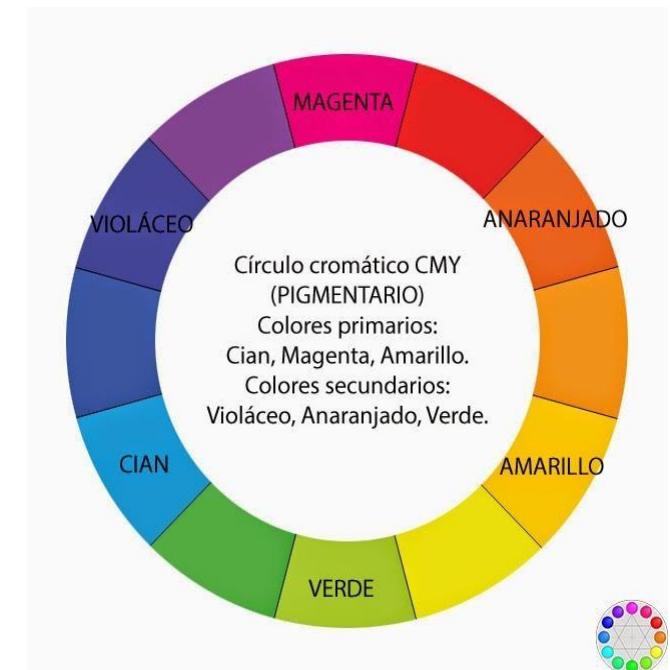
- Conjunt de característiques visuals i tàctils de la superfície d'un material, un objecte, una figura, etc.



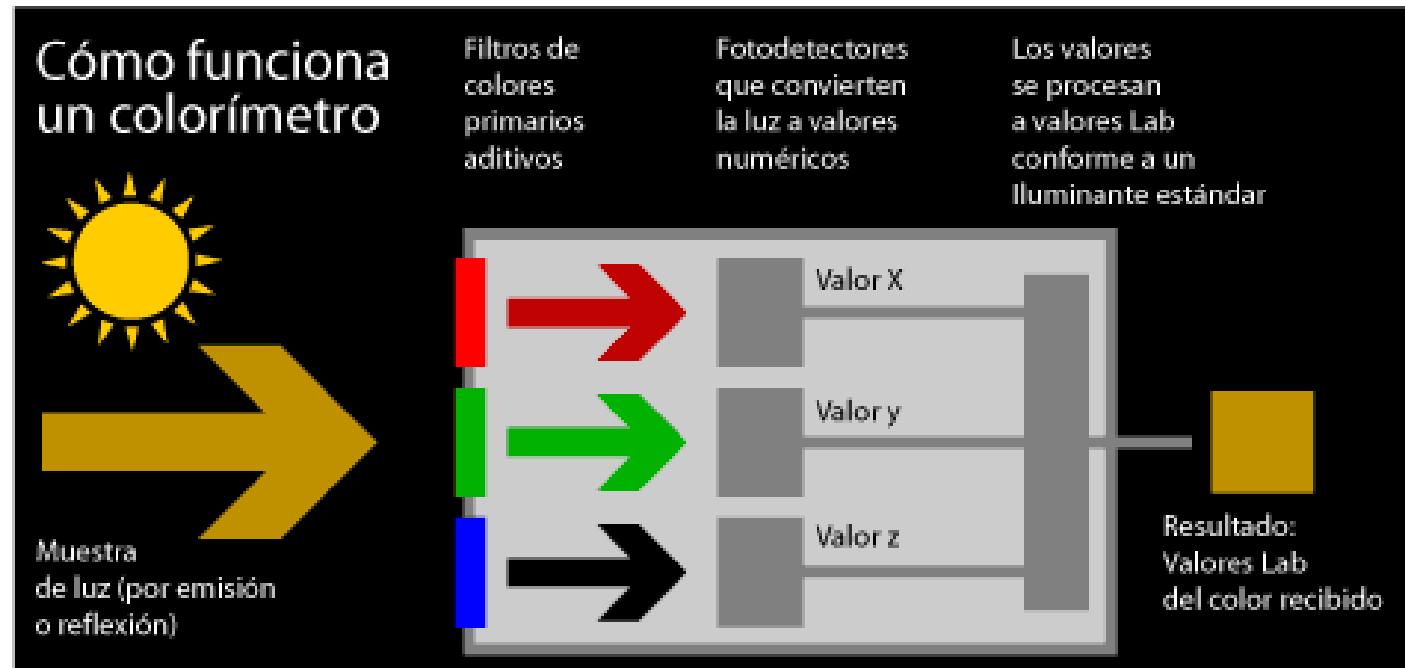
MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

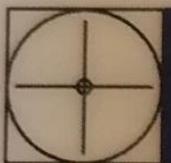
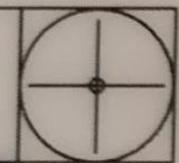
COLOR

- Percepció visual que es genera en el cervell per interpretar les senyals nervioses que envien els fotoreceptors en la retina de l'ull i permeten interpretar i distingir les longituds d'onada que capten de la part visible de l'espectre electromagnètic



COLORIMETRE





8 cm

rectification targets 50mm x 20mm

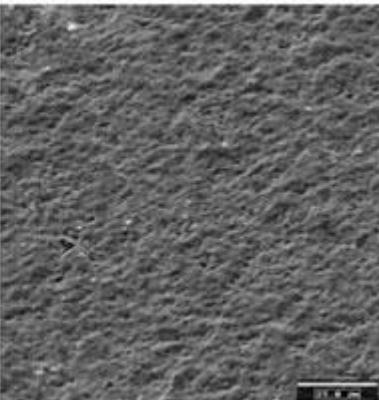
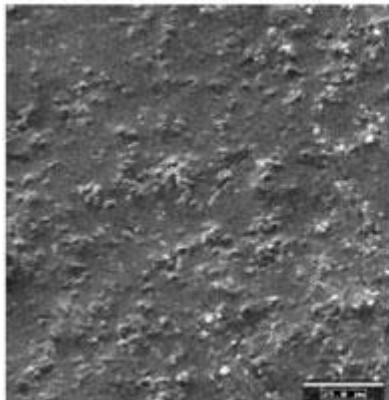
red yellow green blue



Grooved Ware, Orkney, UK



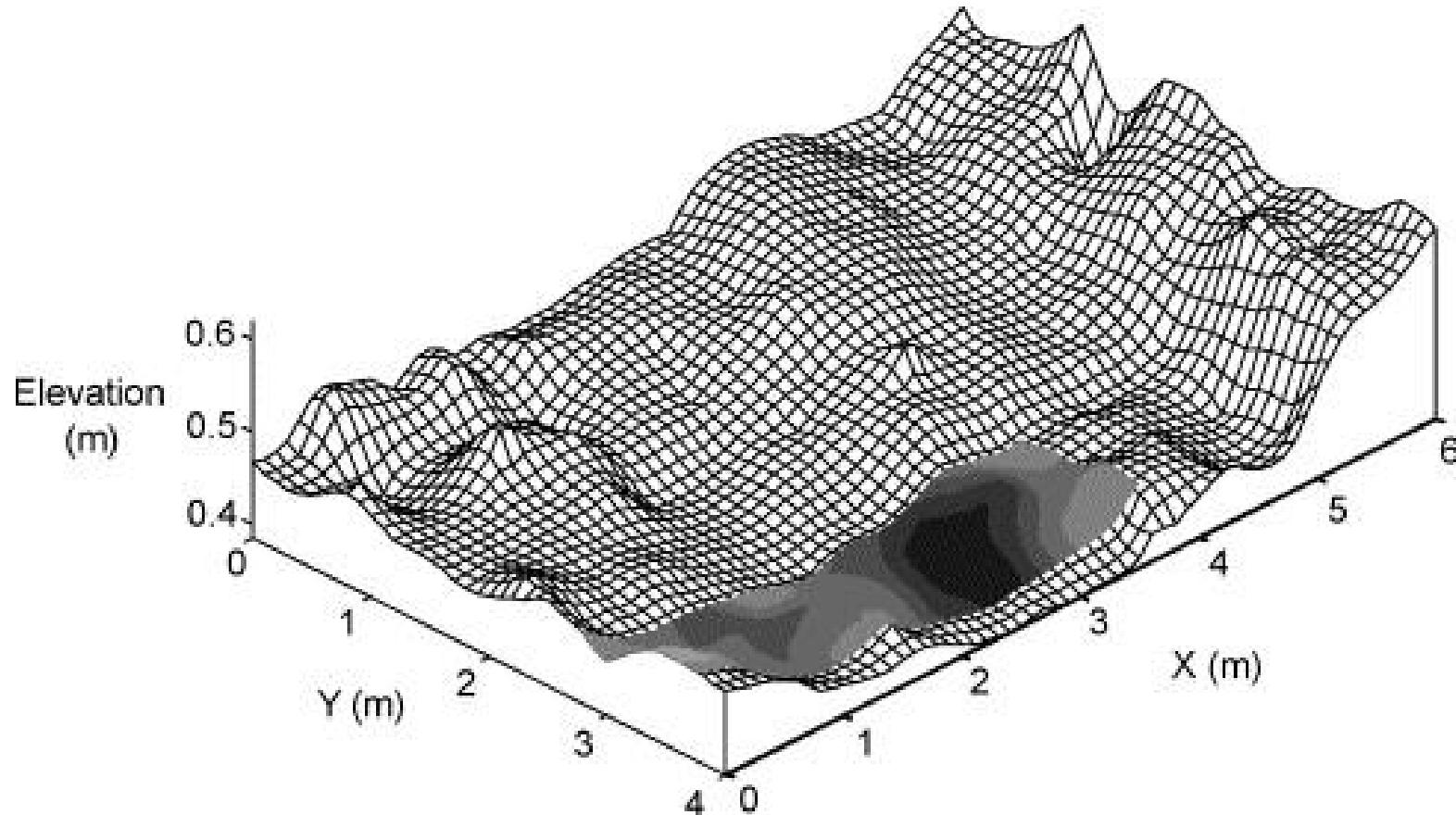
APARENÇA VISUAL



- Surface microtopography
- Color
- Additional properties:
 - Specularity
 - Reflectivity
 - Transparency

Surface-microtopography:

Coarseness, roughness, smoothness, polish, burnish, bumpiness, waviness



El model Leica DCM8 és un microscopi de metrologia de superfícies 3D que combina la microscòpia confocal i la interferometria en un instrumento



Surface-microtopography:

Coarseness, roughness, smoothness, polish, burnish, bumpiness, waviness

MICROTOPOGRAPHY: 3D SURFACE TEXTURE REFERENCES: [ASME-B46.1-2009], [VARADI_2004]; SEE [MASAD_2007], [WHITEHOUSE_2002]		3D Areal parameter	2D Profile parameter
S_a: average roughness	The arithmetic average deviation of the surface (the absolute values of the measured height deviations from the mean surface taken within the evaluation area).	Amplitude	Height
S_q: root mean square (rms) roughness	The root mean square average deviation of the surface (the measured height deviations from the mean surface taken within the evaluation area).	Amplitude	Height
S_{sk}: skewness	A measure of the asymmetry of surface heights about the mean surface.	Amplitude	Shape
S_{ku}: kurtosis	A measure of the peakness of the surface heights about the mean surface.	Amplitude	Shape
S_z: ten point height of the surface (8 nearest neighbor)	2D approximate: Height function, Z(x,y); and Maximum area peak height, S _p .	Amplitude	Height
S_{ds}: density of summits	2D approximate: C number of peaks.	Amplitude	Area Spacing
S_{tr}: texture aspect ratio	Is a measure of the spatial isotropy or directionality of the surface texture.	Spatial	Other parameters
S_{al}: fastest decay autocorrelation length	Only to be interpreted in 3D.	Spatial	-
S_{td}: texture direction of surface	Is determined by the APSD (Angular Power Spectral Density Function) and is a measure of the angular direction of the dominant lay comprising a surface.	Spatial	Other parameters
SΔq: area root mean square surface slope, (S _{dq})	The root mean square sum of the x and y derivatives of the measured topography over the evaluation area.	Hybrid	Other parameters
SΔq (θ): area root mean square directional slope, (S _{dq} θ)	The root mean square average of the derivative of the measured topography along a selected direction, (θ), calculated over the sampling area.	Hybrid	Other parameters
S_{sc}: mean summit curvature	Evaluated for each summit and then averaged over the area. Based on a summit.	Hybrid	-
S_{dr}: developed surface area ratio	Developed Interfacial Area Ratio. 2D approximate: L _r .	Hybrid	
S_{bi}: surface bearing index		Functional – Index family (*1)	-
S_{ci}: core fluid retention index	Geometrically speaking, S _{ci} represents the value of empty volume pertaining to a sampling surface unit of the core zone, as referred to S _q . 2D approximates: R _k parameters.	Functional – Index family (*1)	

Surface-microtopography:

Coarseness, roughness, smoothness, polish, burnish, bumpiness, waviness

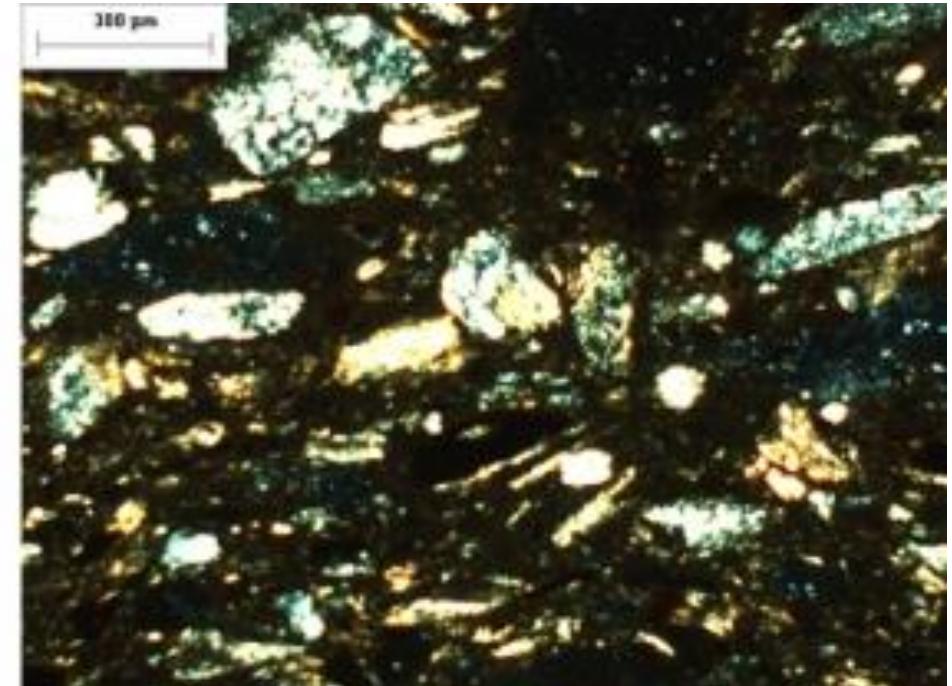
Std: texture direction of surface	Is determined by the APSD (Angular Power Spectral Density Function) and is a measure of the angular direction of the dominant lay comprising a surface.	Spatial	Other parameters
SΔq: area root mean square surface slope, (Sdq)	The root mean square sum of the x and y derivatives of the measured topography over the evaluation area.	Hybrid	Other parameters
SΔq (θ): area root mean square directional slope, (Sdq θ)	The root mean square average of the derivative of the measured topography along a selected direction, (θ), calculated over the sampling area.	Hybrid	Other parameters
Ssc: mean summit curvature	Evaluated for each summit and then averaged over the area. Based on a summit.	Hybrid	-
Sdr: developed surface area ratio	Developed Interfacial Area Ratio. 2D approximate: <i>Lr</i> .	Hybrid	
Sbi: surface bearing index		Functional – Index family (*1)	-
Sci: core fluid retention index	Geometrically speaking, Sci represents the value of empty volume pertaining to a sampling surface unit of the core zone, as referred to Sq. 2D approximates: <i>Rk</i> parameters.	Functional – Index family (*1)	
Svi: valley fluid retention index	It is a parameter similar to Sci. It represents the value of empty volume pertaining to a sampling surface unit of the valley zone, as referred to Sq.	Functional – Index family (*1)	
Sm: surface material volume	Volume from top to 10% bearing area	Functional – Volume family (*1)	
Sc: core void volume	Volume enclosed 10%-80% bearing area	Functional – Volume family (*1)	
Sv: valley void volume	Volume from 80% to 100% bearing area	Functional – Volume family (*1)	
Area power spectral density function, APSD	The square of the amplitude of the Fourier transform of the measured topography. This 3D function is used to identify the nature of periodic features of the measured topography. 2D: Single profiles through the function can be used to evaluate lay characteristics.	??	Other Parameters
Area autocovariance function, AACV	This 3D function is used to determine the lateral scale of the dominant surface features present on the measured topography. 2D: The autocovariance function is a measure of similarity between two identical but laterally shifted profiles. Single profiles through the function can be used to evaluate lay characteristics.	??	Other Parameters
Area autocorrelation function, AACF			Other Parameters
area waviness height, SWt	The area peak-to-valley height of the filtered topography from which roughness and part form have been removed.		Waviness
surface bearing area ratio	The ratio of (the area of intersection of the measured topography with a selected surface parallel to the mean surface) to (the evaluation area).		Other Parameters
average peak-to-valley	Is intended to include those parameters that evaluate the profile height by		Additional

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

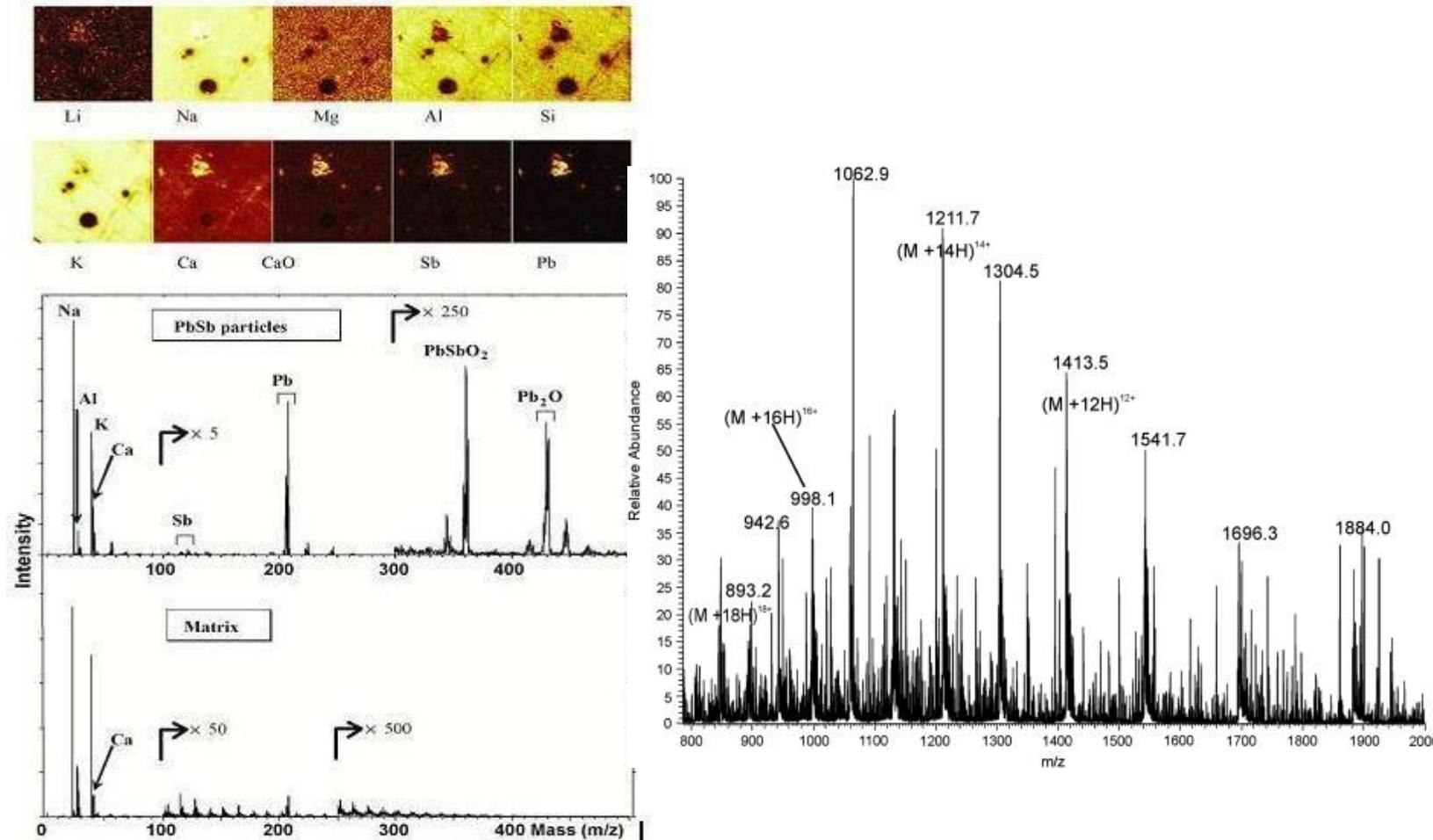
4. MATERIALITAT

4.1. COMPOSICIÓ

- Propietats estructurals dels artefactes
- Per exemple:
 - ◆ CERÀMICA: Calç, Quars, Alumini, Silici, etc.
 - ◆ NECÒPOLIS: Tomba, Tumul, Llosset sepulcral, Estela, etc.
 - ◆ CASA: Parets, Sòl, Teulada, etc.



BEYOND VISUAL DATA: Compositional Data





Inici | Inserció | Presentació de la pàgina | Fòrmules | Dades | Revisió | Visualització | Complements | Acrobat

Retalla | Arial 10 A A | Ajusta el text | Nombre | Normal | Bé | Suma auto

Copia | Combina i centra | Aplica-hi format de taula | Incorrecte | Neutral | Emplena | Esborra

Enganxa | Copia el format | Tipus de lletra | Alineació | Nombre | Porta-retalls | Insereix | Suprimeix | Format | Cel·les |

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	anid	sourceper	short_rdf	short_date	long_rdf	long_date	material	area	as	la	lu	nd	sm	u	yb	ce	co	cr
2	KDA100	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	2.7704	12.3101	0.2567	9.7463	2.8771	0.0000	1.5261	30.3537	14.6725	10.9471
3	KDA101	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	3.9658	10.9178	0.2658	13.1155	3.4487	0.0000	1.7601	27.9328	13.9977	10.3384
4	KDA102	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	5.9637	11.2744	0.2732	13.5235	3.5512	0.5736	1.8887	27.1354	13.7279	12.4674
5	KDA103	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	4.4381	10.8076	0.2358	11.1308	3.0698	0.5337	1.6380	27.6146	17.7405	16.7530
6	KDA104	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	5.5085	10.1540	0.2743	14.4333	3.1711	0.4262	1.8008	25.9253	14.8156	10.7011
7	KDA105	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	0.0000	11.5532	0.2651	13.3784	3.1923	0.5643	1.5851	28.3182	15.4589	16.4790
8	KDA106	Miriam Stark	SARD2-S	06/04/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	4.0830	10.8705	0.2317	9.6663	3.1123	0.7808	1.6910	28.2777	18.3074	17.3471
9	KDA107	Miriam Stark	SARD2-S	06/04/1995	CRUZB2	02/07/1995	Ethnog. Pottery	Philippines	7.5992	12.1178	0.2941	15.6410	3.3221	0.7226	1.7403	26.4639	15.8209	14.7548
10	KDA108	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	7.4905	13.5706	0.3043	19.0106	3.8609	0.7990	2.0648	29.5236	17.8438	24.1116
11	KDA109	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	5.2806	11.4892	0.2916	16.4156	3.4471	0.9596	1.8639	26.1206	15.1246	16.1631
12	KDA110	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.5444	11.6659	0.2986	11.3133	3.5971	0.6959	1.9364	27.4043	15.7280	15.2763
13	KDA111	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	9.8208	13.3130	0.3288	15.9880	4.0432	0.4821	2.2058	28.6924	15.6237	14.9911
14	KDA112	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	1.9123	9.2440	0.2211	9.0707	2.4645	0.5365	1.3503	29.5532	17.5874	13.1411
15	KDA113	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	1.7828	9.0987	0.2141	7.5038	2.3323	0.7859	1.4326	29.3681	17.5103	12.6043
16	KDA114	Miriam Stark	RTMN2	11/05/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	1.6867	8.5742	0.1947	9.6216	2.3676	0.6428	1.3319	28.2921	17.8208	12.4921
17	KDA115	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	0.0000	9.3031	0.2073	13.6112	2.4713	0.6505	1.3374	29.5058	17.6096	13.0694
18	KDA116	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	2.7873	19.7588	0.3244	16.0122	4.2191	1.2947	2.0009	35.2008	16.8897	29.2254
19	KDA117	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	1.5627	10.8292	0.2226	7.9731	2.6056	0.0000	1.4379	29.6627	18.6974	10.3051
20	KDA118	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	3.8453	11.4971	0.2691	11.6067	3.4263	0.6306	1.8823	29.3277	14.7284	10.7821
21	KDA119	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.2623	12.0740	0.2872	14.2098	3.5882	0.0000	1.8982	29.2461	15.2769	14.8431
22	KDA120	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	5.8749	12.2130	0.3059	13.8567	3.5766	0.5078	1.9810	28.0649	14.8379	15.9511
23	KDA121	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.2658	12.7016	0.3256	14.8913	3.7960	0.0000	2.1442	30.4228	13.5398	15.6691
24	KDA122	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.1796	13.0664	0.3183	11.5927	3.7730	0.7169	2.0688	31.0043	13.6926	14.5691
25	KDA123	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	4.9121	11.3998	0.2536	9.8425	3.0226	0.7566	1.6424	27.1533	16.1612	16.0241
26	KDA124	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	7.8261	14.0307	0.3374	14.6081	3.3374	1.2232	1.9566	30.6803	17.4962	23.4821
27	KDA126	Miriam Stark	HERZ1BS	13/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	10.0292	13.0138	0.3195	16.5735	3.5712	0.8101	2.0101	27.7543	16.9202	15.3591
28	KDA127	Miriam Stark	HERZ1BS	13/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	11.0016	13.0069	0.3380	14.1848	3.8769	0.0000	2.3543	27.2723	17.0938	15.1941
29	KDA128	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	14.9076	14.4196	0.4072	16.1817	4.3733	0.6568	2.5747	29.9526	15.2644	19.6401
30	KDA129	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	9.2287	13.2499	0.3392	16.6265	3.9822	0.8268	2.1165	31.2294	14.0866	15.1711
31	KDA130	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.7923	12.1926	0.2956	13.9719	3.3549	0.0000	1.8832	26.9585	16.7751	18.4091
32	KDA131	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	7.3995	11.2338	0.2716	13.0028	3.3984	0.0000	1.8163	24.2140	18.1513	12.8301
33	KDA132	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	13.6865	13.5497	0.3316	15.0782	3.9516	0.0000	2.1802	28.1389	18.2052	17.3541
34	KDA133	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	6.9844	13.1494	0.3159	14.6753	3.7220	0.3266	2.0041	29.5500	15.4749	16.7561
35	KDA134	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	11.5183	13.3871	0.3309	12.8611	3.8139	0.5564	2.4699	27.9699	14.2655	15.7663
36	KDA135	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	3.7117	12.7091	0.2559	13.7013	3.2031	0.0000	1.6175	32.6563	40.3315	10.3971
37	KDA136	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	16.2502	14.9935	0.4010	17.9624	4.7220	0.9534	2.7109	31.5732	15.9273	20.8641
38	KDA137	Miriam Stark	MC2-S	06/07/1995	BISH1	09/04/1995	Ethnog. Pottery	Philippines	7.2260	12.8517	0.2876	11.0011	2.5663	0.5602	1.0570	20.2162	15.1050	17.6201

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

4. MATERIALITAT

4.2. PROPIETATS FÍSIQUES I MECÀNIQUES

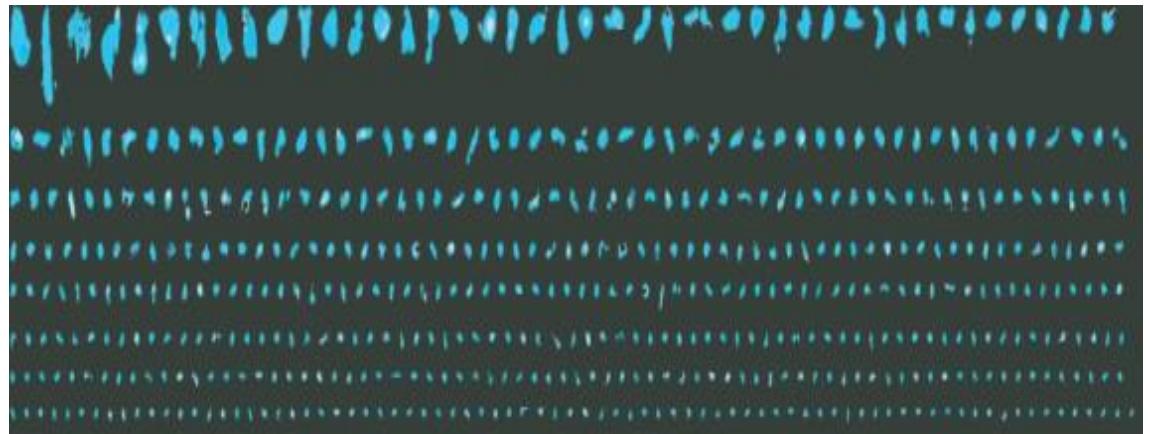
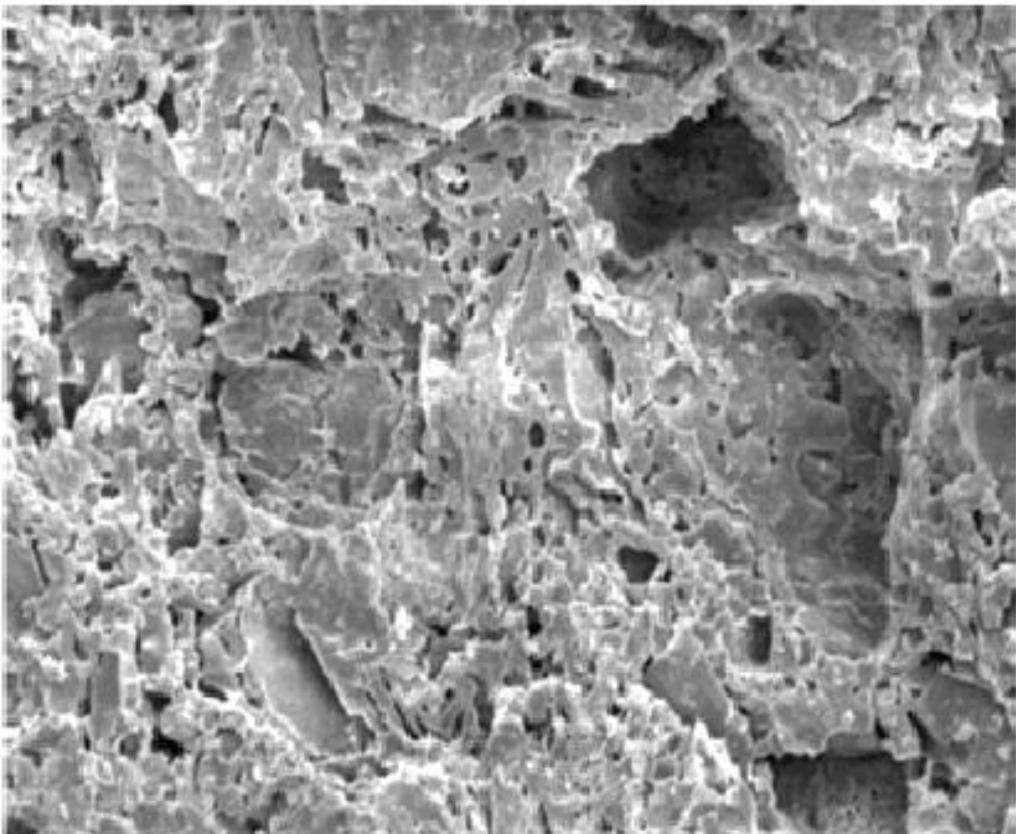
PROPIETATS FÍSIQUES

Permeabilitat
Densitat
Porositat

PROPIETATS MECÀNIQUES

Tensió tèrmica
Elasticitat
Ductilitat
Tenacitat
Duresa
Resiliència

Exemple: Mesurant la porositat



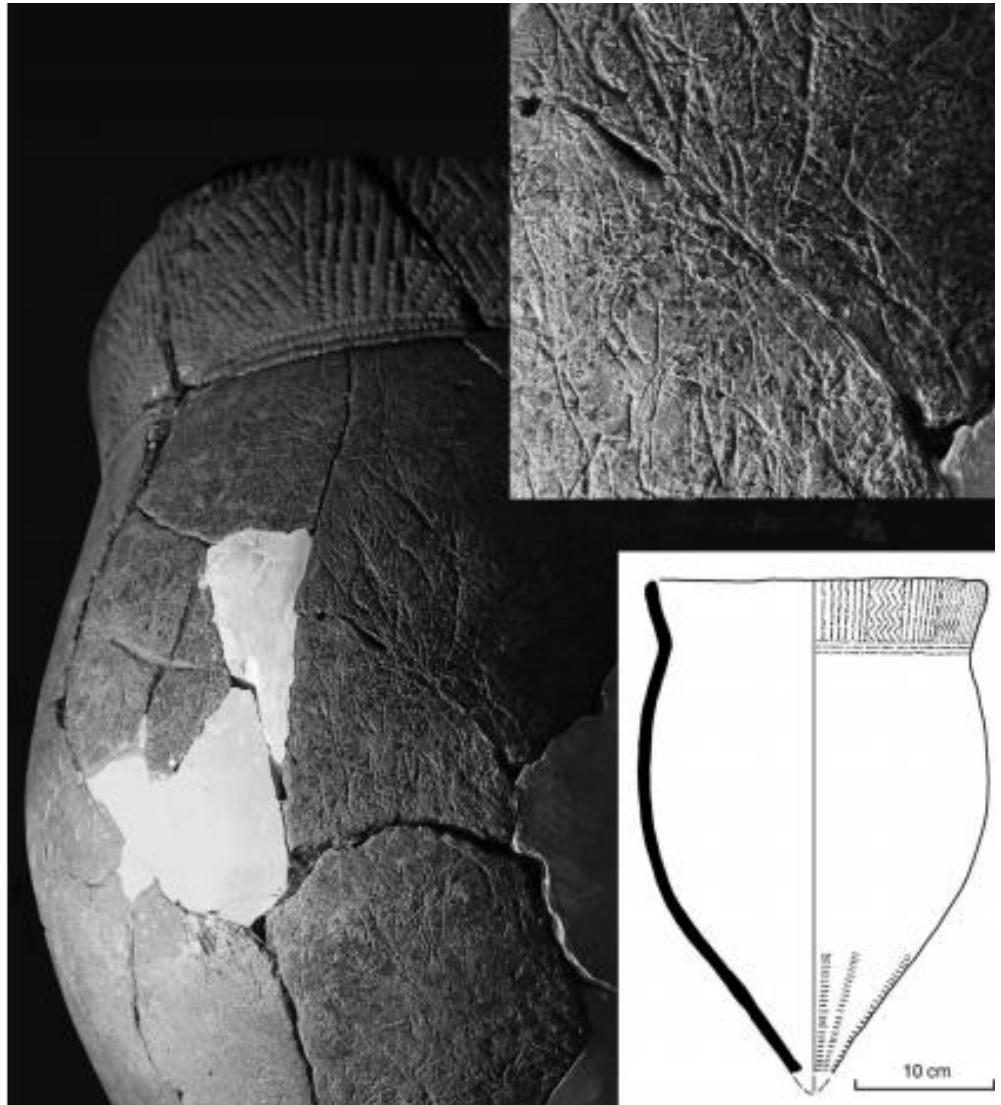
imatges DIA, Reedy et al., 2014

Group	Mean water saturation (g)	Mean quick absorption (g)	Quick dip: saturation (%)
U1	18.3	9.3	51.22
U2	19.4	10.0	51.83
T1	20.5	12.2	59.72
T2	24.0	12.2	50.86

Conèixer la porositat ens pot ajudar per donar resposta a preguntes com:

Per què utilitzaven pèl de cavall com a desgreixant orgànic?
(Jeffra, 2008)

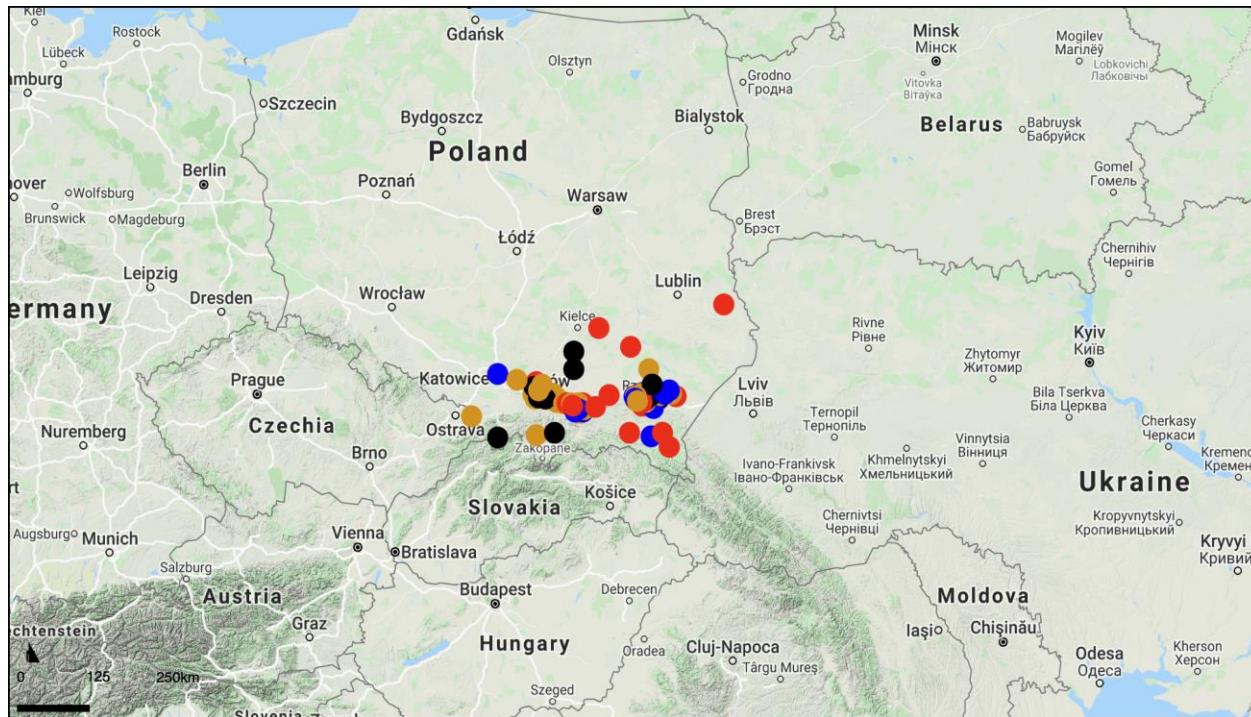
“One of the most plausible explanations for such a decision within the link between mobile groups and organic tempering (...) it seems likely that altered workability would be the aim of this inclusion”



Exemple:

Per què al sud de Polònia durant el període LBK es van substituir el desgreixant orgànic per additius minerals?

(Palacios, 2018)



- Early phase: 5500/5400 - 5300 cal BC
- Middle phase: 5400/5300 - 5000 cal BC
- Late phase: 5100/5000 - 4800 cal BC

Settlement sites

Settlement traces

Camp sites

Sites related to LBK

Methodology:

1. Raw material selection and preparation
2. Modelling, drying and firing
3. Technological tests

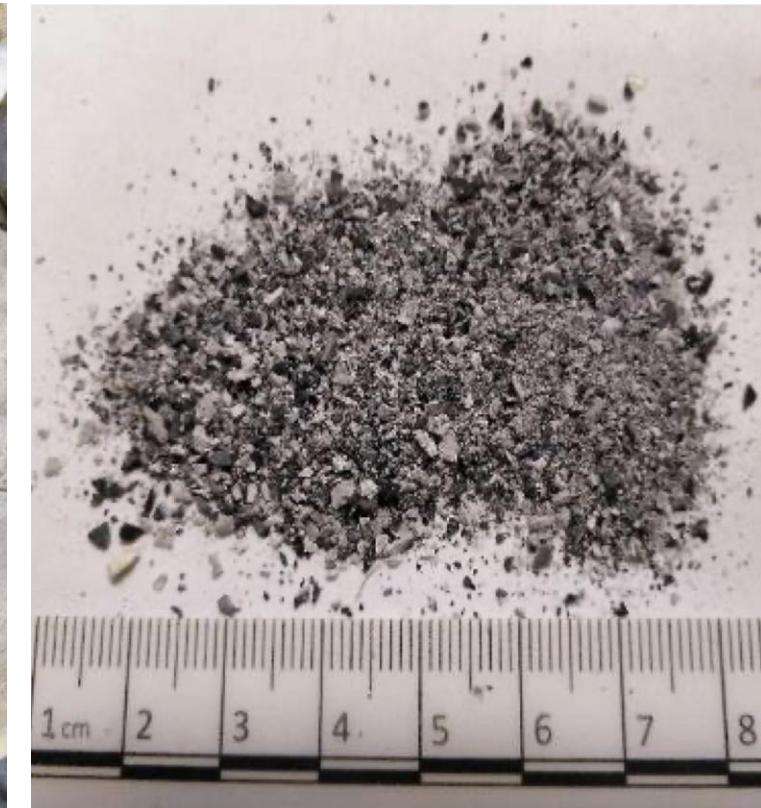
Methodology:

1. Raw material selection and preparation



Methodology:

1. Raw material selection and preparation



Methodology:

2. Modelling, drying and firing

Firing in an electric furnace 700°C for 4 hours



Firing in a pit hearth 650-750°C for 4 hours

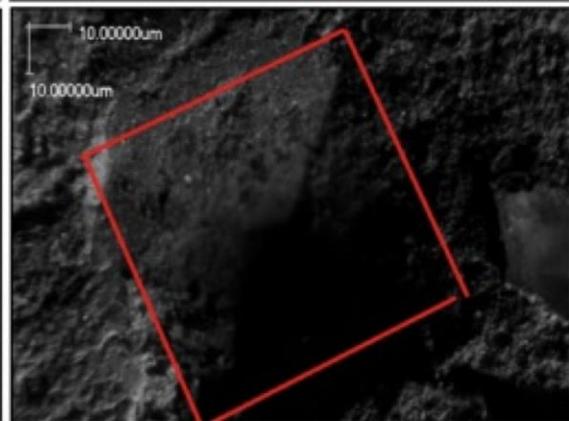
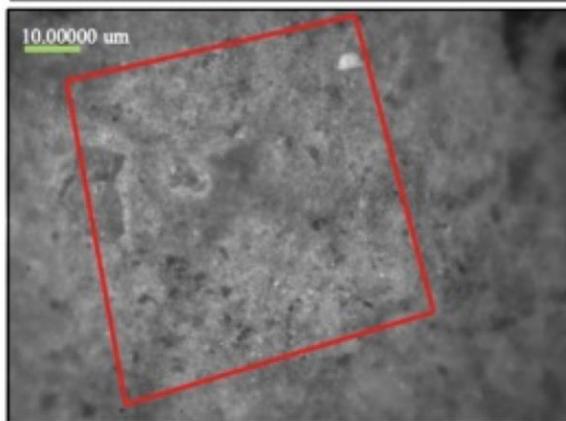
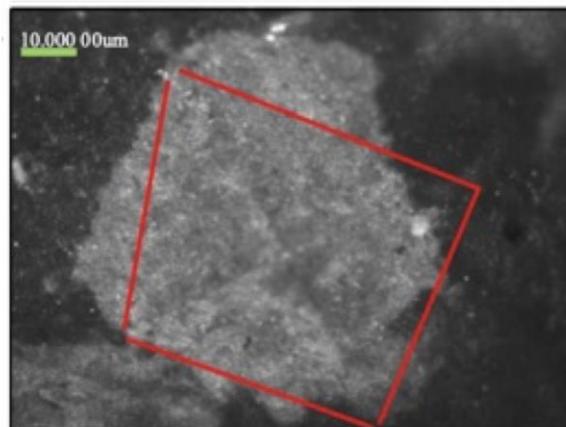


Methodology:

3. Technological tests: Vickers hardness test



Temper	Firing method	Tensile Strength (Pa)
<i>Unburnt bone</i>	Experimental hearth	0,0475
	Electric furnace	0,065
<i>Burnt bone</i>	Experimental hearth	0,0536
	Electric furnace	0,056
<i>Plant chaff</i>	Experimental hearth	0,0513
	Electric furnace	NA
<i>Dung</i>	Experimental hearth	0,0588
	Electric furnace	NA
<i>Grog</i>	Experimental hearth	0,0545
	Electric furnace	0,068
<i>Quartz</i>	Experimental hearth	0,0489
	Electric furnace	0,0698

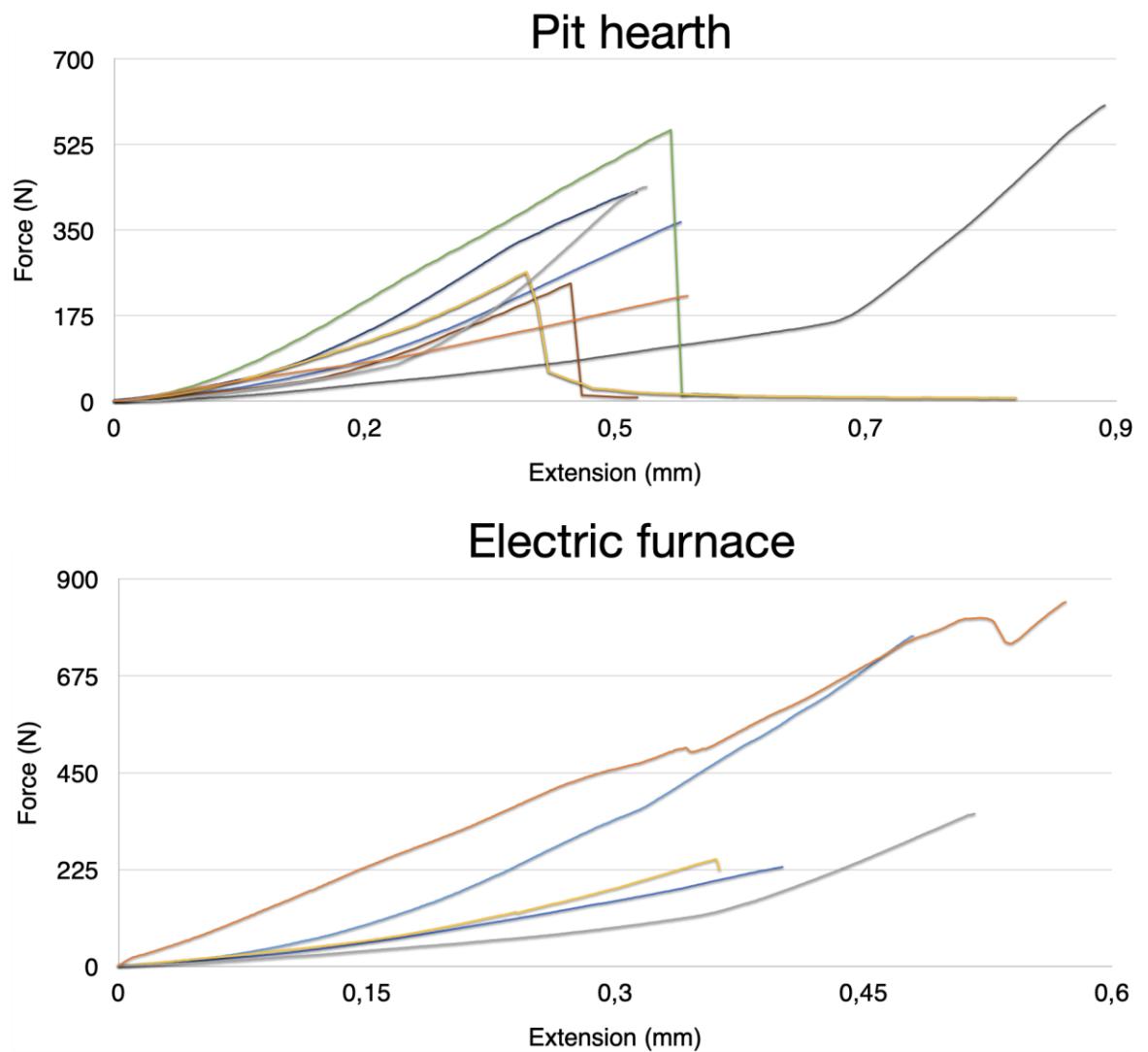


Methodology:

3. Technological tests: three-point bending test



Temper	Firing method	Results (Pa)
<i>Untempered</i>	Experimental hearth	2,335
<i>Unburnt bone</i>	Experimental hearth	4,756
	Electric furnace	0,939
<i>Burnt bone</i>	Experimental hearth	2,865
	Electric furnace	1,599
<i>Plant chaff</i>	Experimental hearth	1,273
	Electric furnace	2,446
<i>Dung</i>	Experimental hearth	1,309
	Electric furnace	0,716
<i>Grog</i>	Experimental hearth	3,060
	Electric furnace	1,495
<i>Quartz</i>	Experimental hearth	3,287
	Electric furnace	1,539



Methodology:

3. Technological tests: water absorption test

Total volume of the sherd (VT) = $(W-S) \cdot 100$

Volume of open pores (VO) = $(W-D) \cdot 100$

Apparent porosity (AP) = $(VO/VT) \cdot 100$

Apparent density (AD) = $(D/VT) / 100$

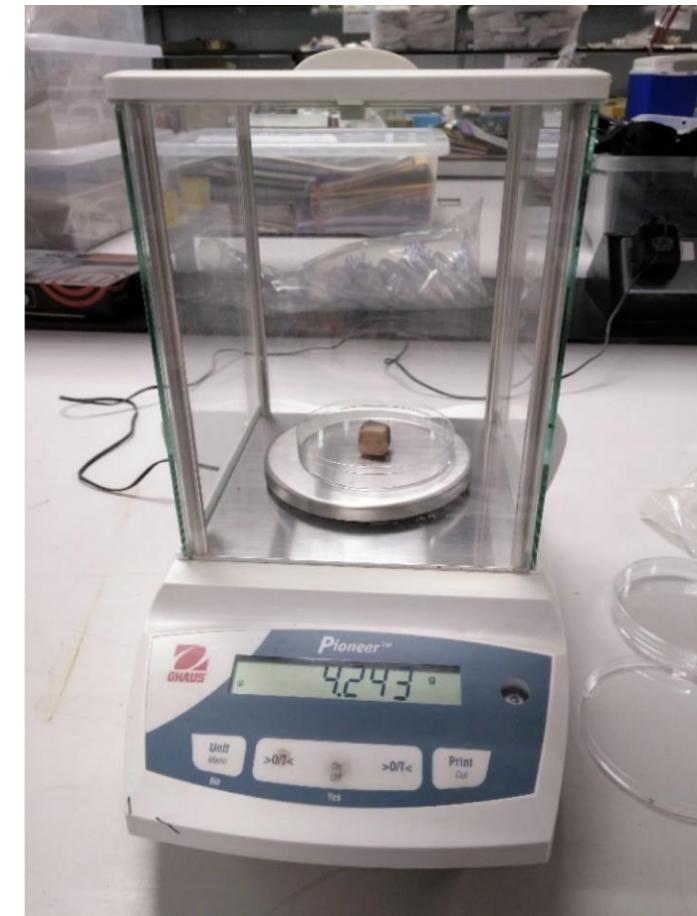
Apparent specific density (AS) = $(D/VT-VO) / 100$

Where:

D: weight of dry sample (nm)

W: weight suspended in water (nm)

S: weight suspended in air (nm)



Temper	Firing method	Apparent porosity (%)	Apparent density (%)	Apparent specific density (%)
<i>Unburnt bone</i>	Experimental hearth	25,88	1,728	2,13
	Electric furnace	40,552	1,466	2,48
<i>Burnt bone</i>	Experimental hearth	29,27	1,612	2,448
	Electric furnace	28,04	1,786	2,478
<i>Emmer chaff</i>	Experimental hearth	37,106	1,75	2,804
<i>Spelt chaff</i>	Experimental hearth	34,573	1,703	3,057
	Electric furnace	43,22	1,62	2,904
<i>Dung</i>	Experimental hearth	59,71	1,587	4,41
	Electric furnace	54,058	1,69	3,874
<i>Grog</i>	Experimental hearth	26,224	1,778	2,412
	Electric furnace	26,224	1,778	2,412
<i>Quartz</i>	Experimental hearth	24,64	1,694	2,332
	Electric furnace	23,748	1,682	2,238

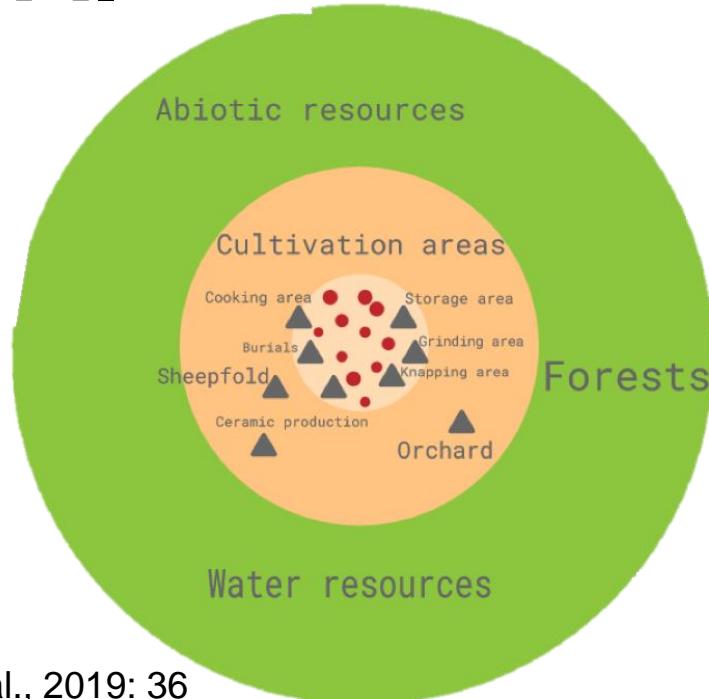
Per què al sud de Polònia durant el període LBK es van substituir el desgreixant orgànic per additius minerals?

- Beneficis basats en la producció: Tots els materials d'enduriment igualment accessibles, excepte el quars: un increment d'eines lític produïdes en les fases mitjana i tardana?
- Beneficis basats en el rendiment: Os, quars i grog amb un rendiment similar: baixa porositat i alta resistència a la fractura. Excrements i palla més fràgils i amb trencament ràpid. Millors recipients per a cuinar?
- Prova de duresa Vickers no adequada.

MEDICIÓ DEL REGISTRE ARQUEOLÒGIC

5. UBICACIÓ

5.1. ESPAI



Adapted from Maestre et al., 2019: 36



Hill of Tara, Irlanda

Què significa "mesurar" la conducta humana?

- ◆ Simplement ordenar els resultats o efectes de la mateixa, d'acord amb escales de referència prèviament construïdes.
- ◆ L'ordenació dels objectes socials és diferent de l'ordenació dels objectes físics, perquè uns i altres tipus d'objectes són diferents, i les propietats quantitatives en les quals es basen les relacions ordinals són distintes.
- ◆ No té sentit mesurar la longitud d'una acció social, però sí la seva intensitat, per exemple.

Es pot mesurar la capitat de poder?



Altres mesures arqueològiques:

- La **quantitat de treball invertida** per a la producció d'un cert element, o el rendiment proporcionat pel treball de caça o pastoreig d'una espècie animal concreta, etc.
- En arqueozoologia és habitual recórrer als **índexs d'utilitat** de la part o element anatòmic de l'animal, a la biomassa obtinguda, etc.
- En arqueologia espacial, potser com a resultat dels models ecològics preses d'altres disciplines més formalitzades, resulta molt més habitual l'ús d'aquests índexs explicatius. Propietats com la **capacitat productiva d'una àrea**, la productivitat del treball en aquella mateixa àrea, la visibilitat i dominància (absoluta o relativa) d'un cert element del paisatge, etc., són índexs que soLEN utilitzar-se en els sistemes d'informació geoarqueològics.