DACORD

Computer-Assisted Drawing of Archaeological Pottery (the CADAPtable system)

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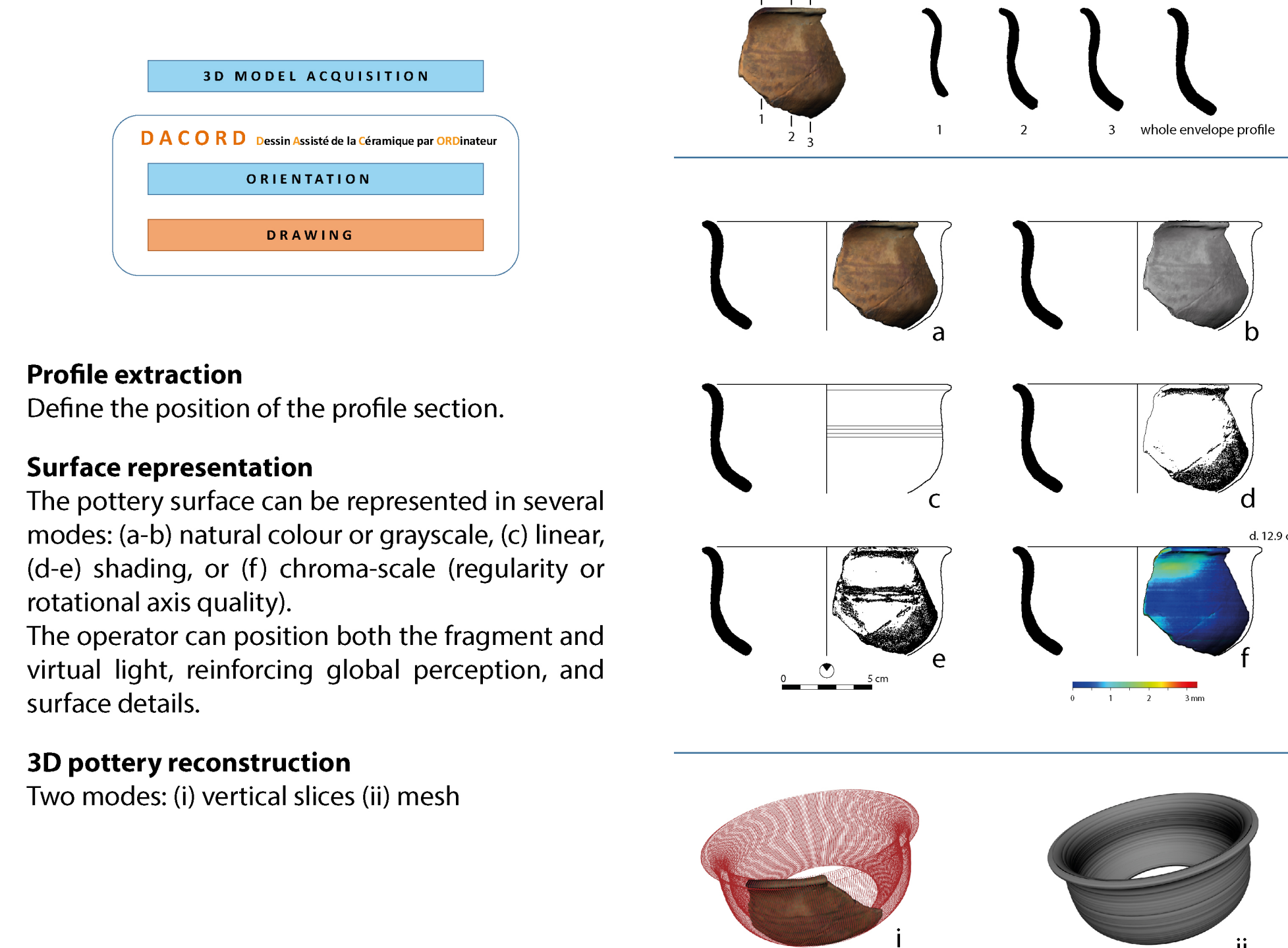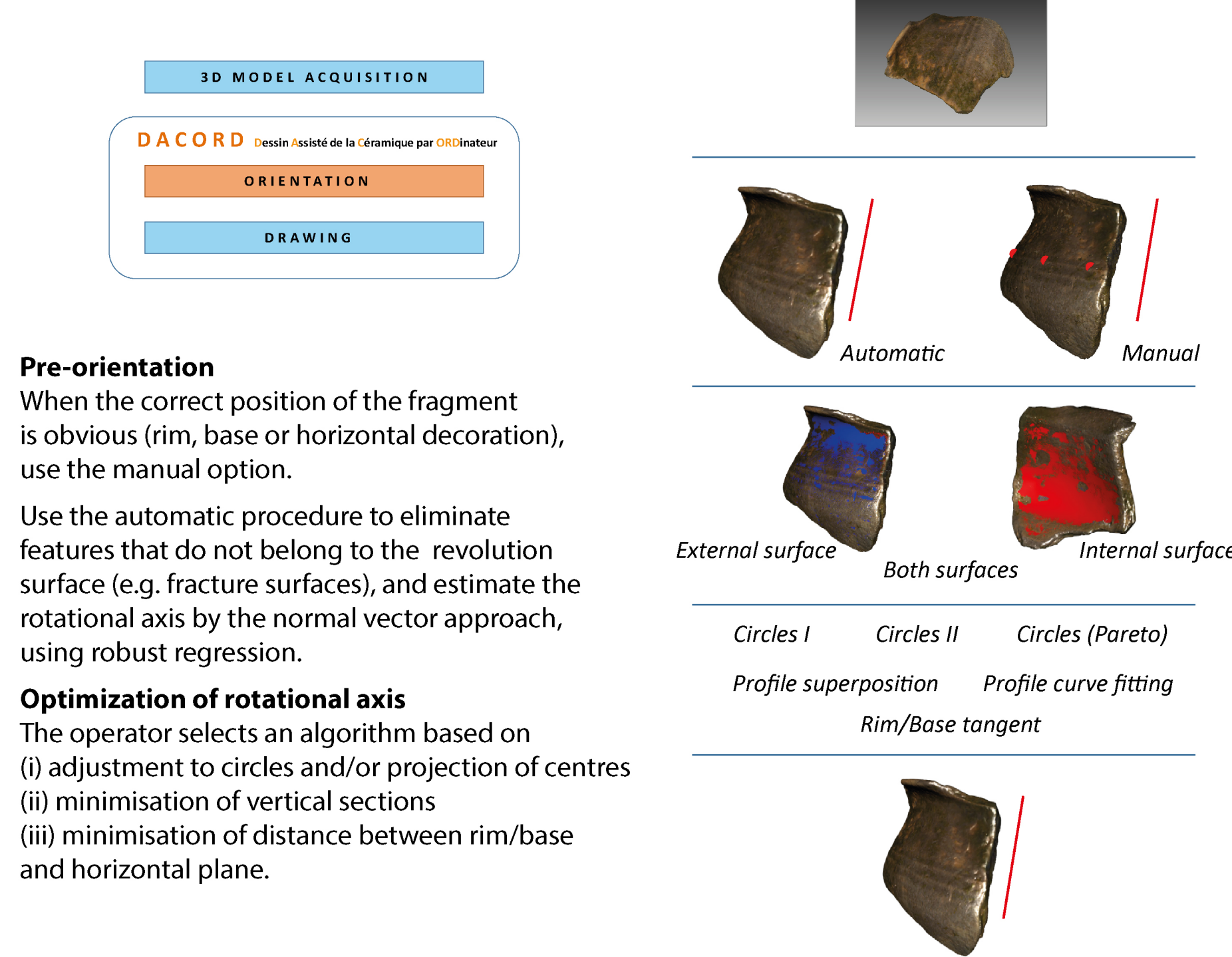
1 Introduction

The DACORD functional system orients and draws archaeological pottery, based on 3D model geometry, using modern mathematical, graphical, optimization methods.

The orientation workflow combines existing approaches (normal vectors, horizontal/vertical sections, etc.) with new methods, to segment fragments (external and internal surfaces), and to erase parts that provide no information about the rotational axis (fractures, plastic decoration, etc.).

Archaeological illustrations adapted to most norms and standards of pottery drawings can then be produced from these correctly oriented models.

All pottery orientation and drawing methods are implemented in DACORD software, developed in R. The DACORD system thus represents a new optimized solution for archaeology.

2 General orientation and drawing workflow

Pre-orientation
When the correct position of the fragment is obvious (rim, base or horizontal decoration), use the manual option.

Use the automatic procedure to eliminate features that do not belong to the revolution surface (e.g. fracture surfaces), and estimate the rotational axis by the normal vector approach, using robust regression.

Optimization of rotational axis
The operator selects an algorithm based on
(i) adjustment to circles and/or projection of centres
(ii) minimisation of vertical sections
(iii) minimisation of distance between rim/base and horizontal plane.

Profile extraction
Define the position of the profile section.

Surface representation
The pottery surface can be represented in several modes: (a-b) natural colour or grayscale, (c) linear, (d-e) shading, or (f) chroma-scale (regularity or rotational axis quality).
The operator can position both the fragment and virtual light, reinforcing global perception, and surface details.

3D pottery reconstruction
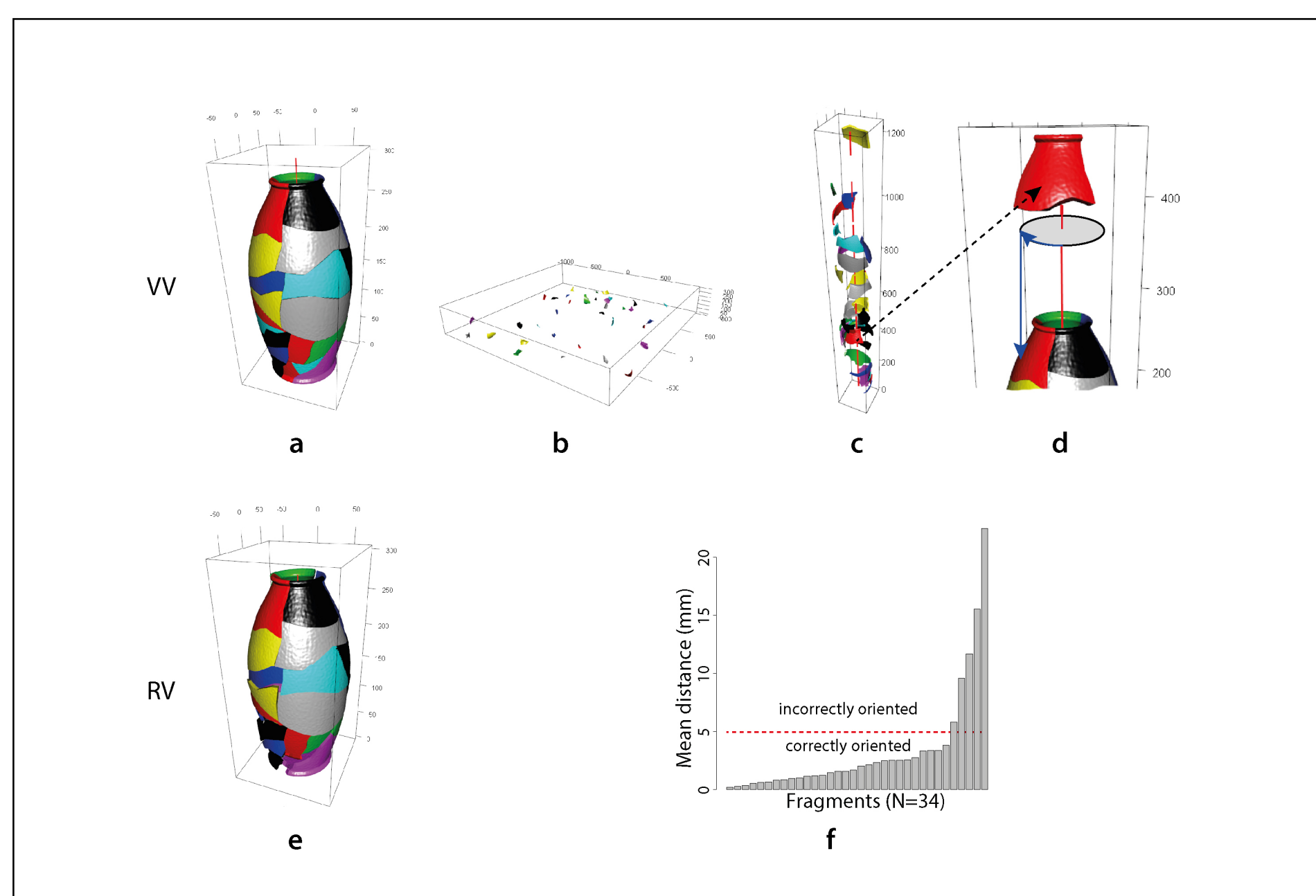Two modes: (i) vertical slices (ii) mesh

3 Automatic orientation

Virtual vessel test

The virtual vessel with surface noise (VV)

(a) was broken into 34 fragments
(b) randomly translated and rotated
(c) automatically oriented
(d) aligned with the original
(e) to form a reconstructed vessel (RV)

(f) shows distances between VV and RV

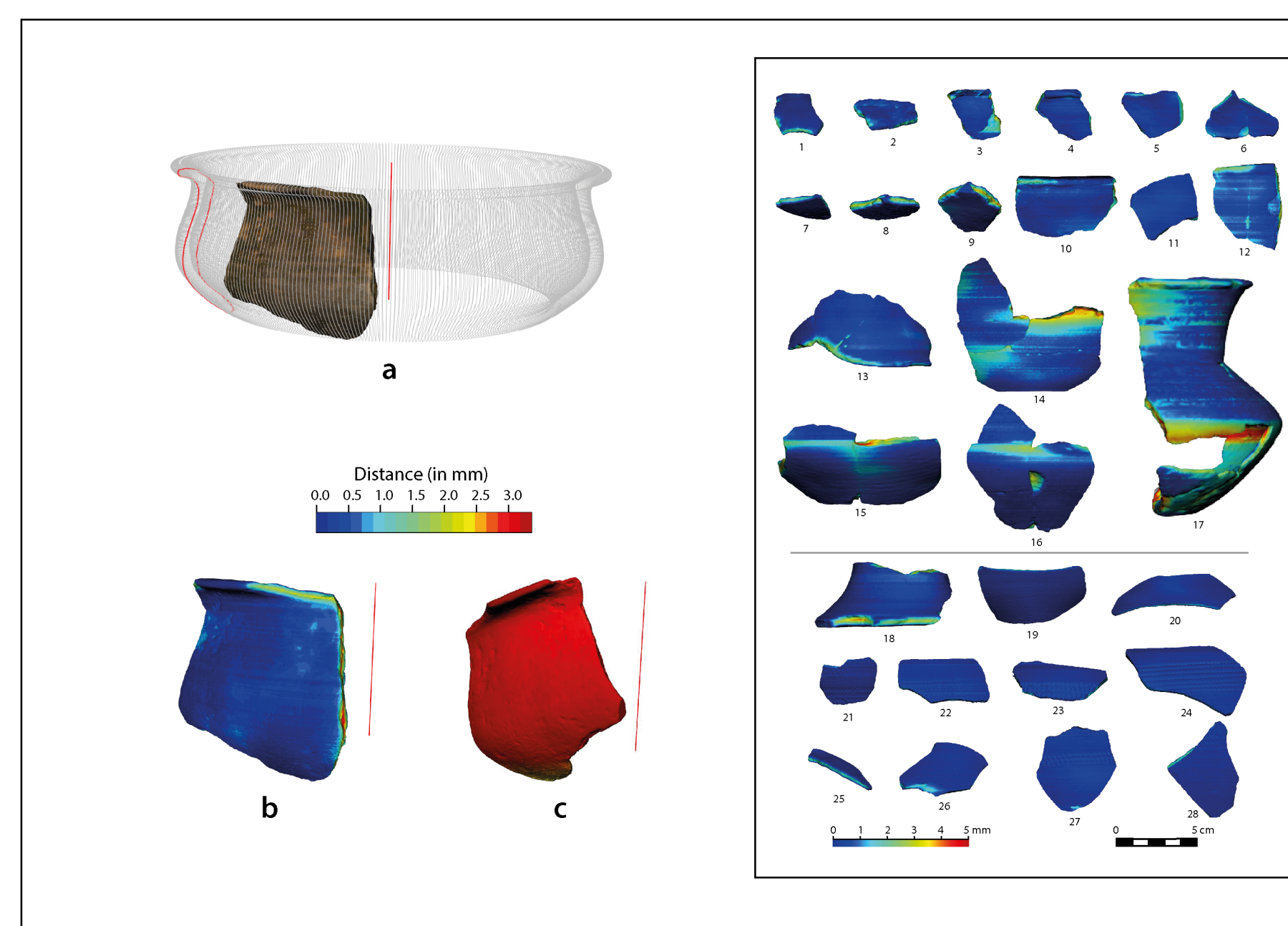**Success rate**
91%

Real-world fragment test

110 fragments
3 periods (Neolithic, Bronze Age, Roman)
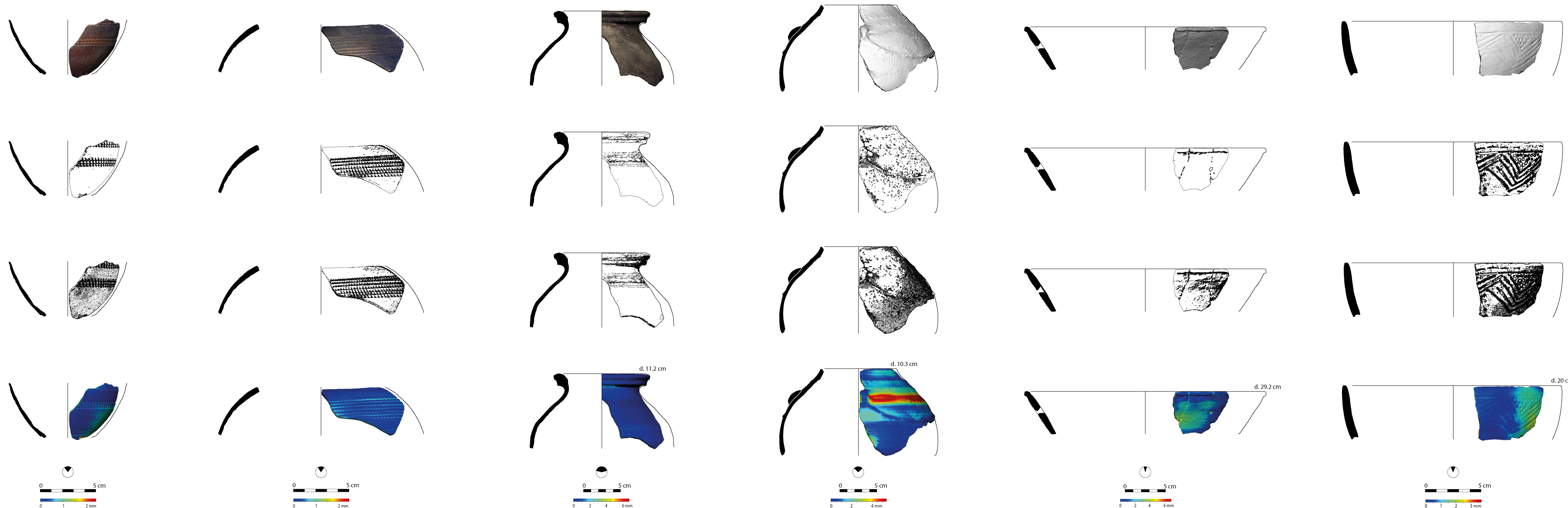
(a) automatic fragment orientation

Chromo-scale is used to identify
(b) correctly oriented fragments
(c) incorrectly oriented fragments

Success rate
69% - fully automatic orientation process
100% - manual pre-orientation + automatic optimization

4 Assisted drawing

5 Conclusion

DACORD advantages:
- intuitive, simple, no statistical knowledge required
- rapid (max. 5 min), precise & reproducible
- simplifies routine archaeological illustration
- all types of pottery (handmade, wheel-turned)
- all sizes & types of fragments (rim, body, base)
- open, flexible, various formats for exportation
- fully automatic workflow, if required
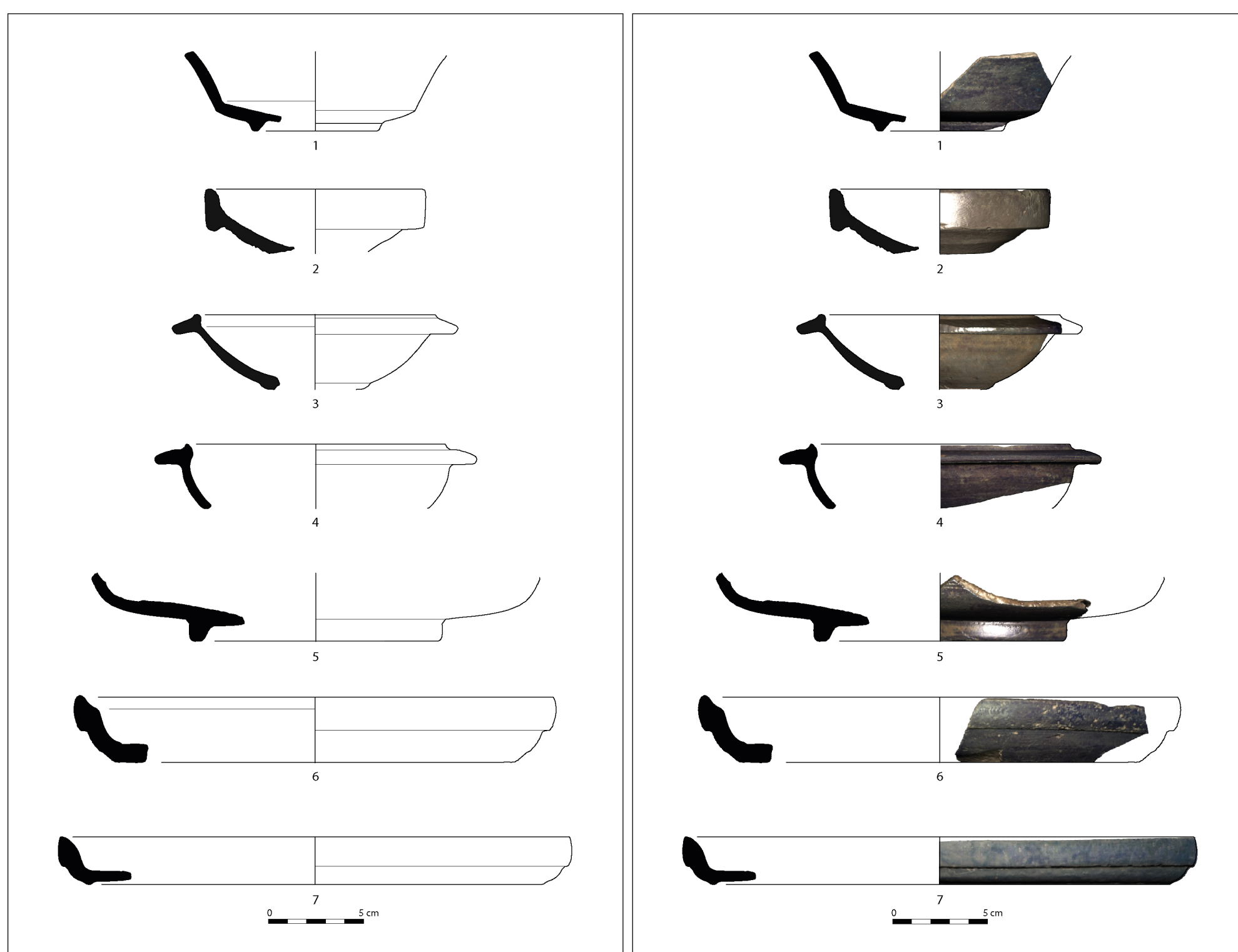
DACORD pushes the boundaries:
- size no longer matters (if curves are present)
- thousands more artefacts can be documented
- the virtual corpus is virtually boundless
- results are easily catalogued, archived, classified
  & shared world-wide
- 3D printing (cultural heritage & digital archaeology)
- customizable, potential for automatic layouts, etc.

Declaration of Inventorship - Declaration of Computer Program - SATT GRAND EST - DACORD