Detailed Measurement of Edged Weapons from the Gotti Collection

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Abstract

In this article, four two-handed swords, 14 one handed swords, one dagger and one rapier blade from the Gotti Collection in Botticino are described in image and text and presented together with their measurements. The weapons cover a wide time range, from the 15th to the 17th century. An authentic reconstruction of the blades is made possible with these measurements. Furthermore, parameters of blade geometry and mass distribution are very illuminative for the interpretation of period fencing treatises.

I. Introduction

DETAILED MEASUREMENTS OF period weapons are the most important source of information for the manufacture of authentic reproductions. Furthermore, parameters of blade geometry and mass distribution are very illuminative for the interpretation of period fencing treatises.

In this article, four two-handed swords, 14 one-handed swords, one dagger and one rapier blade from a wide time range (15th –17th century) are presented with photographs, detailed measurements of blade, hilt and grip as well as cross section diagrams.

II. Terminology

Most of the measurable parameters are common to all swords and quite clear, although some need a more detailed explanation, which follows. The measurement coordinate origin in all planes is the center of the grip front end.

- *Ricasso Length* – Ricasso length is measured from the front end of the grip to the start of the edge.

- *Blade Length* – Blade length is measured from the front end of the grip to the point.

- *Point of Balance (POB)* – The point of balance is usually considered the main parameter of handling and can be easily located by balancing the sword on an edge. However, it only determines a small part of the handling characteristics. It is measured from the front end of the grip.

- *Blade dorsal length* – Length of the flat area on the back of a, usually hexagonal, blade.

- *Pommel Neck Length* – The length of the pommel part that is the transition to the grip, which extends the actual grip length.

- *Crossguard Diameter* – The diameter of the crossguard at its thinnest point. This value is an indicator for the stability of the hilt.

Overall length	l_o
Blade length	l_b
Projected blade length	l_{bp}
Ricasso length	l_r
Ricasso block length	l_q
Grip length	l_g
Pommel length	l_p
Pommel neck length	l_{pn}
Fuller length	l_f
Point of balance	l_{pob}
Hilt height front of crossguard	l_{hf}
Hilt height rear of crossguard	l_{hr}
Blade dorsal length	l_s
Blade width	w_b
Projected blade width	w_{bp}
Projected blade curvature	w_{cp}
Pentagon shape bevel width	w_{bev}
Ricasso width at front end	w_{rf}
Ricasso width at rear end	w_{rr}
Fuller width	w_f
Hilt width	w_h
Grip width at crossguard end	w_{gf}
Grip width at pommel end	w_{gr}
Grip width at distance X	w_{gX}
Blade dorsal width	w_s
Blade thickness	d_b
Spine thickness pentagon/triangle shape	d_s
Pentagon shape bevel thickness	d_{bev}
Ricasso thickness at the front end	d_{rf}
Ricasso thickness at the rear end	d_{rr}
Fuller depth	d_f
Hilt depth outside	d_{ho}
Hilt depth inside	d_{hi}
Grip thickness at the crossguard end	d_{gf}
Grip thickness at the pommel end	d_{gr}
Grip thickness at distance X	d_{gX}
Edge thickness	d_e
Blade cross-section area	A
Overall mass	m

Table 1: Edged Weapon Parameter Overview

III. Blade Cross Section Calculation

Blade cross sections can be calculated along each blade according to its shape. The formulae used are as follows:

III.1. Hexagon Cross Section
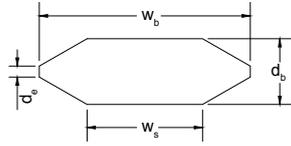
Figure 1: Hexagon Cross Section

$$A = (d_b - d_e)w_s + w_b d_e + \frac{(d_b - d_e)(w_b - w_s)}{2} \tag{1}$$

III.2. Diamond Cross Section
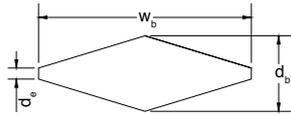
Figure 2: Diamond Cross Section

$$A = w_b d_e + \frac{(d_b - d_e)w_b}{2} \tag{2}$$

III.3. Pentagon Cross Section
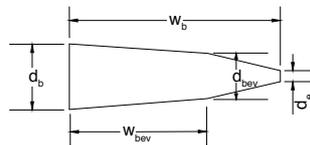
Figure 3: Pentagon Cross Section

$$A = \frac{d_b w_{bev} + w_b d_{bev} + d_e(w_b - w_{bev})}{2} \tag{3}$$

3

III.4. Lenticular Cross Section
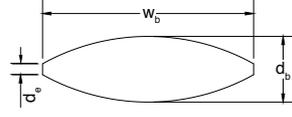
Figure 4: Lenticular Cross Section

Here, cross section is approximated by circle segments, a precise claculation is not possible.

$$A = w_b d_e + \frac{\frac{1}{2}arctan(\frac{(d_b-d_e)}{w_b})((d_b - d_e)^2 + w_b^2) + \frac{(d_b-d_e)}{2}w_b((d_b - d_e)^2 - w_b^2)}{2(w_b - d_e)^2} \tag{4}$$

For sharp blades we can disregard the striking edge and therefore omit parameter d_e.

III.5. Fuller Cross Section
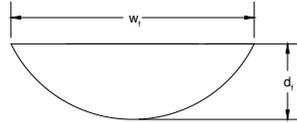
Figure 5: Fuller Cross Section

$$A = \frac{\frac{1}{2}arctan(\frac{2d_f}{w_f})(4d_f^2 + w_f^2)^2 + w_f b(4w_f^2 - w_f^2)}{16w_f^2} \tag{5}$$

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IV. Description and Measurement of 20 Edged Weapons
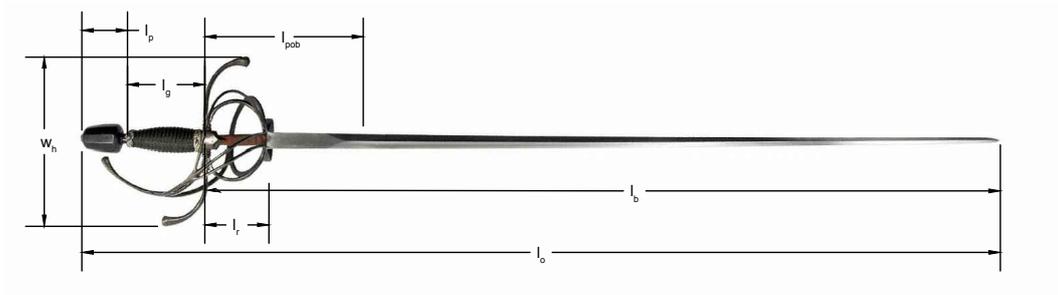
Figure 6: Sketch of a one-handed sword.
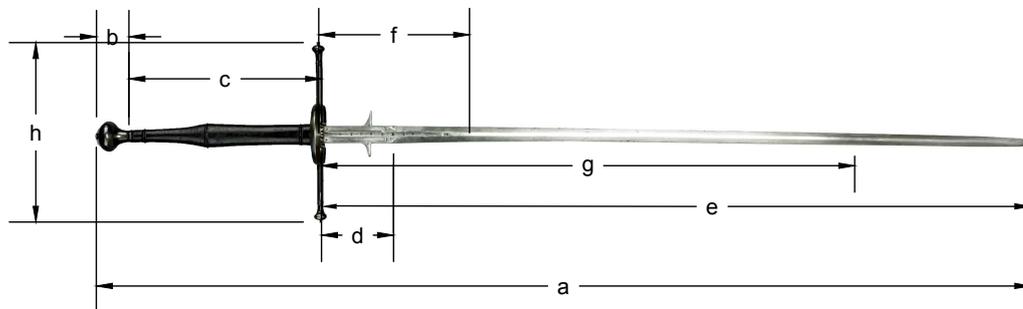
Figure 7: Sketch of a two-handed sword.

IV.1. Object 1

Object 1 is a one–and–a–half hand sword with a blade cross section of a hollow–ground diamond shape along the entire length. The hilt consists of a simple round crossbar, a solid metal protection plate with heart–shaped cutouts on the outside and a simple inner guard with thumb ring. The grip has a double tapered oval cross section ending in an ovoid pommel.
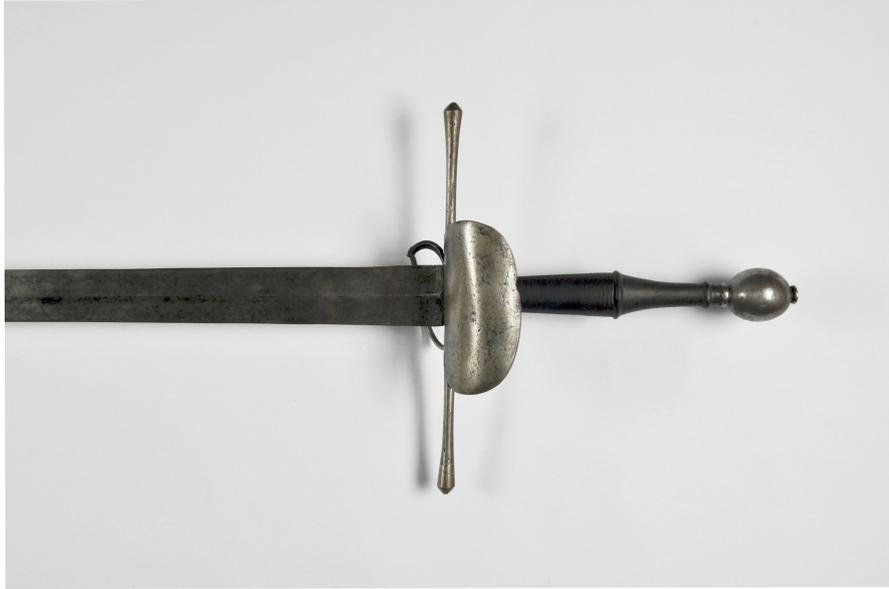
Figure 8: Object 1 – Hilt and forte outside view

Figure 9: Object 1 – Hilt and forte side view

Figure 10: Object 1 – Hilt and forte oblique inside view

Figure 11: Object 1 – Hilt and forte oblique outside view

Figure 12: Object 1 – Debole and point

	Object 1				
Overall length [mm]	1236				
Blade length [mm]	967				
Overall mass [g]	1455				
Point of balance [mm]	96				
Pommel length [mm]	58				
Pommel width [mm]	41.9				
Pommel thickness [mm]	42.1				
Pommel neck length [mm]	6				
Grip length [mm]	203				
Grip shape	oval, both ends conical				
Grip material					
	Distance [mm]	0	70	125	203
Measurements Grip	Width [mm]	26.0	30.0	37.5	17.5
	Thickness [mm]	16.5	20.5	32.5	17.5
Quillon block length [mm]	10				
Quillon block thicness [mm]	18				
Shell thickness	1.9				
Hilt width [mm]	128				
Hilt depth outside [mm]	100				
Crossguard length	305				
Crossguard shape	round				
Crossguard diameter [mm]	8				
Blade shape	Diamond with hollow ground				

Table 2: Overview of the measurement parameters of object 1
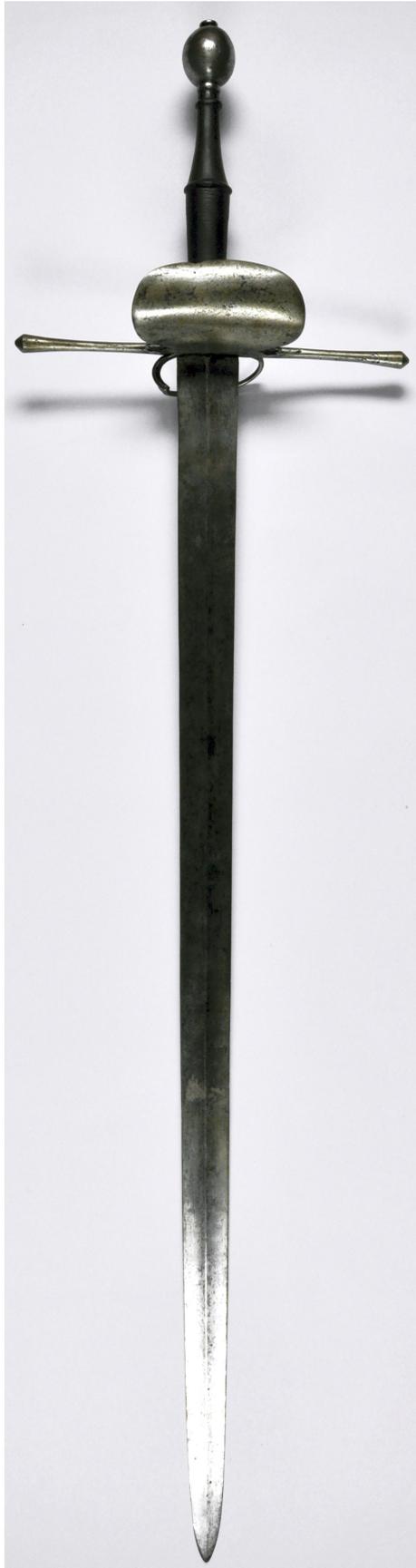
Figure 13: Object 1 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	d_{hg} [mm]	A [mm^2]	Blade shape
0	47.7	9.15	0.6	179.4	Hollow ground diamond
50	46.4	7.55	0.6	137.5	Hollow ground diamond
100	44.6	5.75	0.7	86.2	Hollow ground diamond
200	42.9	5.55	0.4	96.0	Hollow ground diamond
300	40.9	5.35	0.5	81.9	Hollow ground diamond
400	39.8	5.10	0.3	85.4	Hollow ground diamond
500	39.0	5.00	0.3	81.8	Hollow ground diamond
600	37.3	4.75	0.4	68.5	Hollow ground diamond
700	35.8	4.25	0.4	56.8	Hollow ground diamond
800	33.1	4.30	0.4	53.4	Hollow ground diamond
900	27.5	3.00	0.2	33.9	Hollow ground diamond
940	20.6	2.90	0.0	29.9	Diamond

Table 3: Blade measurements of object 1, two-handed sword
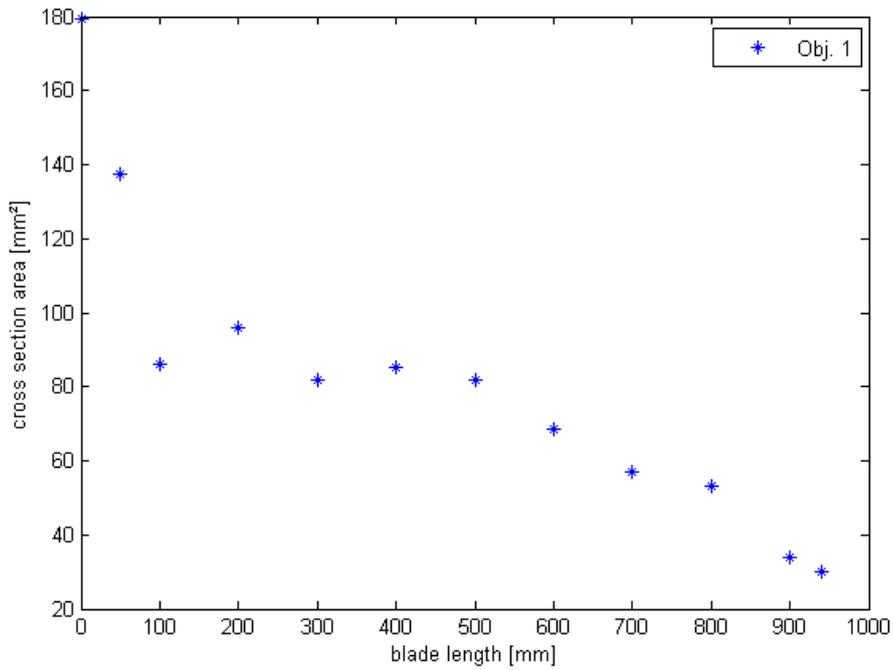
Figure 14: Cross Section of Object 1

A two–handed sword with a long, stiff blade that transitions from rectangular over hexagonal to lenticular along its length. The blade has four fullers, two of them end at the parrying lugs, the center fullers continue for another 32 cm. The hilt is symmetrical with round crossguard and two horizontal rings on either side. The grip is of rounded rectangle cross section and tapers towards the pommel. It is fluted in a chevron pattern and wrapped in wire. The ovoid pommel matches the finials on the crossguard.

Figure 15: Object 2 – Hilt and forte outside view

Figure 16: Object 2 – Hilt oblique outside view

Figure 17: Object 2 – Grip and pommel oblique view

Figure 18: Object 2 – Hilt rear oblique view

Figure 19: Object 2 – Debole and point

	Object 2			
Overall length [mm]	1614			
Blade length [mm]	1185			
Overall mass [g]	2695			
Point of balance [mm]	114			
Pommel length [mm]	75			
Pommel width [mm]	48			
Pommel thickness [mm]	48.7			
Pommel neck length [mm]	12.5			
Grip length [mm]	352			
Grip shape	rectangle with rounded edges			
Grip material	wood with metal wire			
	Distance [mm]	0	200	352
Measurements Grip	Width [mm]	31.5	31.7	22.5
	Thickness [mm]	21.9	24.3	21.2
Ricasso length [mm]	145			
Quillon block length [mm]	14.5			
Quillon block thicness [mm]	22.4			
Crossguard length	362			
Crossguard shape	round			
Crossguard diameter [mm]	8.6			
Fuller length [mm]	2 until 155mm; 2 until 475mm			
Fuller count	4			
Blade shape	rectangle until 145mm, hexagon until 630mm, rest lenticular			
Parrying hook length [mm]	17.5			
Parrying hook thickness [mm]	9.1			

Table 4: Overview of the measurement parameters of object 2

Figure 20: Object 2 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	w_s [mm]	w_{f1} [mm]	d_{f1} [mm]	w_{f2} [mm]	d_{f2} [mm]	A [mm²]	Blade shape
0	45.4	6.8	0.0	10.7	1.2	10.7	1.2	239.6	Rectangle
100	41.1	7.4	0.0	9.8	1.6	9.8	1.0	235.1	Rectangle
200	40.5	6.8	20.0	8.7	1.2	0.0	0.0	177.4	Hexagon
300	37.8	6.1	17.8	7.4	1.0	0.0	0.0	149.6	Hexagon
400	36.1	5.8	17.5	6.8	0.9	0.0	0.0	138.9	Hexagon
500	33.9	4.9	15.5	0.0	0.0	0.0	0.0	121.0	Hexagon
600	32.6	5.0	13.5	0.0	0.0	0.0	0.0	115.3	Hexagon
700	32.1	5.1	0.0	0.0	0.0	0.0	0.0	109.7	Lenticular
800	30.7	4.5	0.0	0.0	0.0	0.0	0.0	92.5	Lenticular
900	29.1	3.9	0.0	0.0	0.0	0.0	0.0	75.9	Lenticular
1000	28.7	3.6	0.0	0.0	0.0	0.0	0.0	69.1	Lenticular
1100	26.6	3.4	0.0	0.0	0.0	0.0	0.0	60.5	Lenticular
1150	20.5	2.9	0.0	0.0	0.0	0.0	0.0	39.8	Lenticular

Table 5: Blade measurements of object 2, two-handed sword
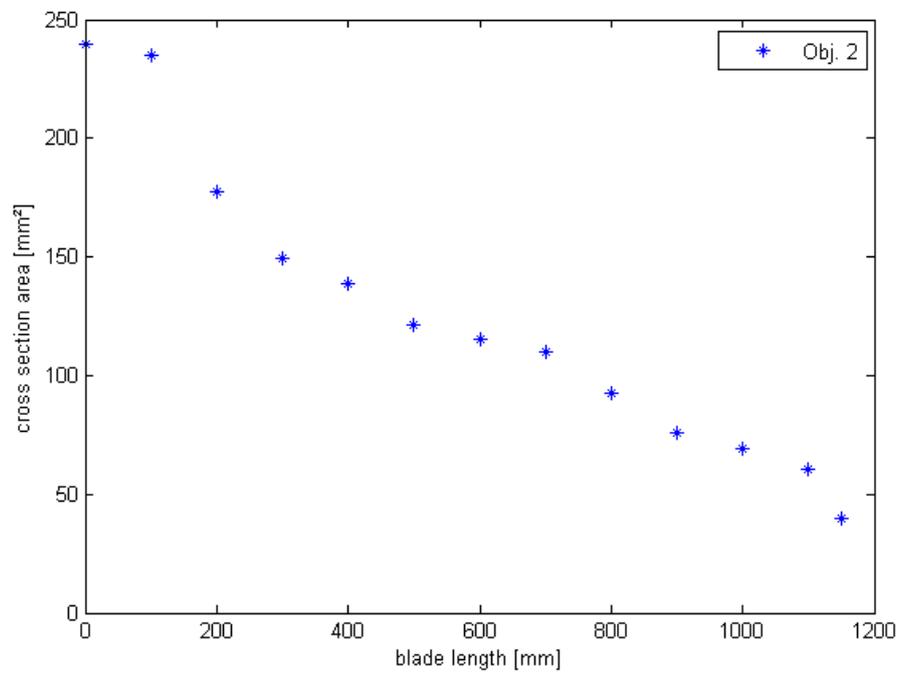
Figure 21: Cross Section of Object 2

This two–handed sword is a similar type of weapon that is depicted in Achille Marozzo's Opera Nova [Marozzo, 1536] but can be dated earlier to about 1450-1500. Its long and slender blade it is suitable for cuts as well as thrusts. The blade has three fullers and parrying lugs and transitions from rectangular to hexagonal cross section along its length. The crossguard is of simple round shape, the grip consists of a wooden core, tapering towards the pommel, decorated with spiral flutes and covered in leather. A plain, pear–shaped pommel completes the sword.

- *Sword Type*: Type XX mit 3 Kannelierungen
- *Hilt Type*: Type 11 with added plate for hand protection
- *Pommel*: Type T5, somewhat compressed

Figure 22: Object 3 – Hilt and forte top view

Figure 23: Object 3 – Hilt and forte side view

Figure 24: Object 3 – Ricasso oblique view

Figure 25: Object 3 – Ricasso oblique side view

Figure 26: Object 3 – Grip and pommel oblique view

	Object 3		
Overall length [mm]	1485		
Blade length [mm]	1128		
Overall mass [g]	1974		
Point of balance [mm]	82		
Pommel length [mm]	75.5		
Pommel width [mm]	43.7		
Pommel thickness [mm]	43.5		
Grip length [mm]	280		
Grip shape	oval, both ends conical		
Grip material	wood with leather		
	Distance [mm]	0	120	280
Measurements Grip	Width [mm]	30.1	31.5	19.5
	Thickness [mm]	20.5	25.0	19.5
Ricasso length [mm]	82		
Quillon block length [mm]	53.5		
Quillon block thickness [mm]	24.7		
Crossguard length	372		
Crossguard shape	round		
Crossguard diameter [mm]	8.1		
Fuller length [mm]	2 until 265mm, 1 until 410mm		
Fuller count	3		
Blade shape	rectangle until 263mm, hexagon until point		
Parrying hook length point-point [mm]	72.5		

Table 6: Overview of the measurement parameters of object 3

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf1 [mm]	df1 [mm]	wf2 [mm]	df2 [mm]	A [mm²]	Blade shape
0	41.9	7.0	0.0	5.5	0.8	4.5	0.8	277.5	Rectangle
45	31.6	6.4	0.0	5.5	0.8	4.5	0.8	186.4	Rectangle
100	30.5	6.1	0.0	5.5	0.8	4.5	0.5	174.0	Rectangle
200	29.5	6.1	0.0	4.5	0.8	4.0	0.7	167.4	Rectangle
300	28.5	6.1	3.8	0.0	0.6	0.0	0.0	111.3	Hexagon
400	27.2	6.1	2.8	0.0	0.4	0.0	0.0	104.9	Hexagon
500	26.2	5.8	0.0	0.0	0.0	0.0	0.0	97.7	Hexagon
600	25.1	5.2	0.0	0.0	0.0	0.0	0.0	83.7	Hexagon
700	24.3	4.7	0.0	0.0	0.0	0.0	0.0	73.1	Hexagon
800	22.9	4.2	0.0	0.0	0.0	0.0	0.0	61.7	Hexagon
900	21.9	3.4	0.0	0.0	0.0	0.0	0.0	47.8	Hexagon
1000	20.7	2.9	0.0	0.0	0.0	0.0	0.0	38.0	Hexagon
1100	19.5	1.5	0.0	0.0	0.0	0.0	0.0	18.0	Hexagon

Table 7: Blade measurements of object 3, two-handed sword

20
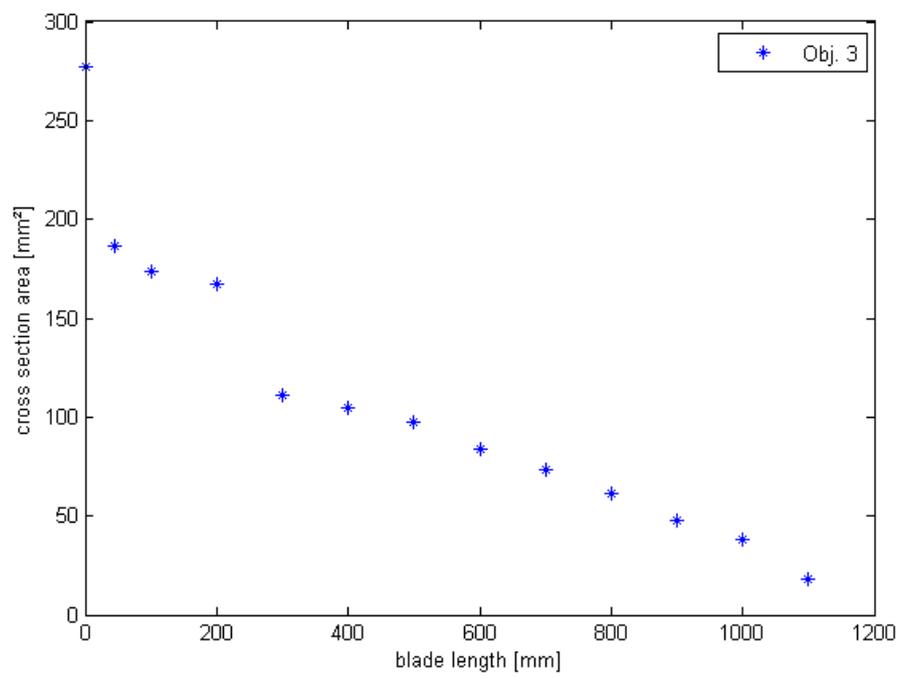
Figure 27: Cross Section of Object 3

IV.4. Object 4

Object 4 is a two–handed sword with a minimally tapering blade of rectangular cross section up to the parrying lugs, then continuing in hexagon cross section with a wide central fuller. Its hilt is a simple symmetrical style with crossguard and side rings, yet richly decorated with chiseled stylised acanthus leaves. The matching pommel is of pear shape, the tapered grip is wrapped with steel and copper wire and turks–head's knots at both ends.

Figure 28: Object 4 – Hilt and forte top view

Figure 29: Object 4 – Hilt and forte side view

Figure 30: Object 4 – Ricasso oblique view

Figure 31: Object 4 – Parrying lugs oblique view

Figure 32: Object 4 – Grip and pommel oblique view

Figure 33: Object 4 – Debole and point

	Object 4			
Overall length [mm]	1643			
Blade length [mm]	1228			
Overall mass [g]	2760			
Point of balance [mm]	90			
Pommel length [mm]	66			
Pommel width [mm]	12.4			
Pommel thickness [mm]	43.5			
Pommel neck length [mm]				
Grip length [mm]	350			
Grip shape	oval			
Grip material	wood with metal wire			
Measurements Grip	Distance [mm]	0	170	350
	Width [mm]	32.0	39.5	24.0
	Thickness [mm]	22.0	31.0	19.5
Ricasso length [mm]	161			
Quillon block length [mm]	49			
Quillon block thickness [mm]	23			
Quillon block width [mm]	56			
Crossguard length	505			
Crossguard shape	diamond			
Crossguard diameter [mm]	13.5 x 8			
Fuller length [mm]	390			
Fuller count	1			
Blade shape	rectangle until 161mm, rest hexagon			
Parrying hook length [mm]	39.5			
Parrying hook thickness point [mm]	4.5			

Table 8: Overview of the measurement parameters of object 4

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	39.1	8.9	0.0	22.5	1.2	311.9	Rectangle
100	32.4	7.7	0.0	17.3	0.9	228.7	Rectangle
140	31.9	7.7	0.0	14.2	0.9	228.5	Rectangle
170	39.8	7.5	20.5	14.0	0.8	211.2	Hexagon
200	37.9	7.2	19.8	13.3	0.6	197.1	Hexagon
300	34.7	5.8	18.2	14.5	1.0	134.0	Hexagon
400	33.1	6.1	14.3	0.0	0.0	144.6	Hexagon
500	30.7	6.0	13.8	0.0	0.0	111.3	Hexagon
600	30.4	4.8	13.5	0.0	0.0	105.4	Hexagon
700	30.0	4.7	14.5	0.0	0.0	104.6	Hexagon
800	29.5	3.9	14.5	0.0	0.0	85.8	Hexagon
900	29.1	3.5	14.0	0.0	0.0	75.4	Hexagon
1000	28.1	3.1	14.0	0.0	0.0	65.3	Hexagon
1100	27.5	2.7	12.3	0.0	0.0	53.7	Hexagon
1200	24.3	2.2	11.2	0.0	0.0	39.1	Hexagon

Table 9: Blade measurements of object 4, two-handed sword
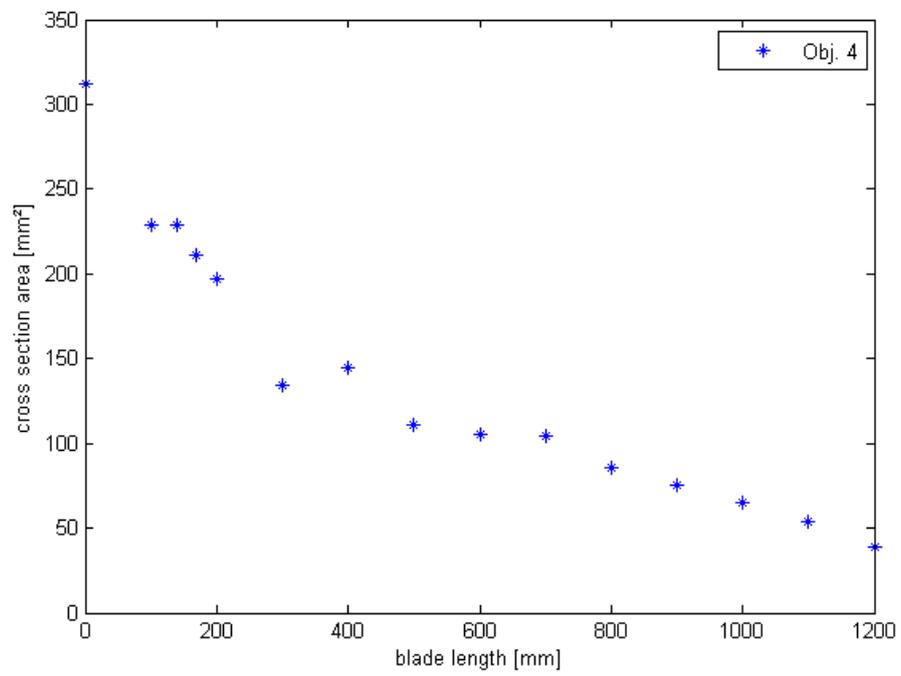
Figure 34: Cross Section of Object 4

A hand–and–a–half sword with a strong hexagonal blade with one central fuller. The hilt consists of a simple round crossguard and one side ring. The grip is made of wood, wrapped with cord to create a spiral pattern and covered in leather. It tapers towards the pommel, which is of an interesting double–cone shape.

Figure 35: Object 5 – Hilt and forte outside view

Figure 36: Object 5 – Hilt and forte side view

Figure 37: Object 5 – Hilt and forte oblique outside view

Figure 38: Object 5 – Grip and pommel oblique view

Figure 39: Object 5 – Debole and point

	Object 5			
Overall length [mm]	1328			
Blade length [mm]	1075			
Overall mass [g]	1710			
Point of balance [mm]	129			
Pommel length [mm]	64.5			
Pommel width [mm]	49.5			
Pommel thickness [mm]	49.5			
Grip length [mm]	189			
Grip shape	oval			
Grip material	wood with leather			
	Distance [mm]	0	80	189
Measurements Grip	Width [mm]	31.0	32.5	20.5
	Thickness [mm]	24.0	28.0	21.5
Quillon block length [mm]	18			
Quillon block thickness [mm]	24			
Hilt width [mm]	96			
Hilt depth [mm]	95			
Crossguard length	230			
Crossguard shape	oval			
Crossguard diameter [mm]	12 x 10			
Fuller length [mm]	257			
Fuller count	1			
Blade shape	rectangle until 90mm, hexagon until point			

Table 10: Overview of the measurement parameters of object 5

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	38.5	6.9	0.0	12.5	1.0	248.9	Rectangle
100	36.7	6.0	15.0	10.0	0.6	147.1	Hexagon
200	34.6	5.4	11.5	8.0	0.4	120.2	Hexagon
300	31.6	5.3	10.5	0.0	0.0	111.6	Hexagon
400	30.4	5.2	9.3	0.0	0.0	103.2	Hexagon
500	29.0	4.5	9.0	0.0	0.0	85.5	Hexagon
600	28.7	4.4	8.5	0.0	0.0	81.8	Hexagon
700	27.5	3.7	7.7	0.0	0.0	65.1	Hexagon
800	26.6	3.6	7.7	0.0	0.0	61.7	Hexagon
900	25.4	3.4	8.0	0.0	0.0	56.8	Hexagon
1000	23.7	2.7	7.0	0.0	0.0	41.4	Hexagon
1040	22.2	2.5	6.0	0.0	0.0	35.3	Hexagon

Table 11: Blade measurements of object 5, two-handed sword
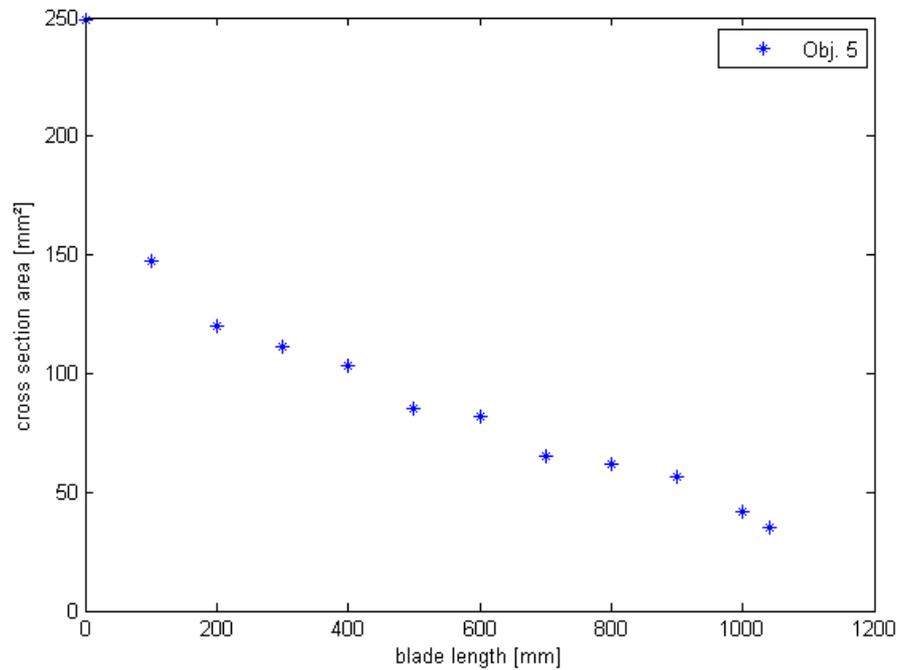
Figure 40: Cross Section of Object 5

IV.6. Object 6

This object is a typical parrying dagger. It has a very stiff blade of hollow–ground diamond cross section with shallow decorative fullers to the sides of the central ridge. The hilt is made up of forward curved quillons and a simple side ring, a wire bound grip with turks–head knots and a tapering, cylindrical pommel with flutes.

Figure 41: Object 6 – Total view

Figure 42: Object 6 – Hilt oblique outside view

Figure 43: Object 6 – Hilt rear oblique view

Figure 44: Object 6 – Blade shape oblique view

	Object 6			
Overall length [mm]	394			
Blade length [mm]	275			
Overall mass [g]	316			
Point of balance [mm]	5			
Pommel length [mm]	42			
Pommel width [mm]	25			
Pommel thickness [mm]	25.5			
Pommel neck length [mm]	8.5			
Grip length [mm]	79			
Grip shape	oval, both ends conical			
Grip material	metal wire			
	Distance [mm]	0	40	79
Measurements Grip	Width [mm]	20	22	17
	Thickness [mm]	17.5	19	15
Quillon block length [mm]	9			
Quillon block thickness [mm]	14.5			
Quillon block width [mm]	30			
Ring width [mm]	31.5			
Ring thickness [mm]	3.2 to 5.6			
Crossguard length	107			
Crossguard shape	oval			
Crossguard diameter [mm]	6 x 3.5			
Blade shape	hollow ground diamond			

Table 12: Overview of the measurement parameters of object 6

l_b [mm]	w_b [mm]	d_b [mm]	dhg [mm]	A [mm^2]	Blade shape
0	21.5	7.6	0.7	60.4	Hollow ground diamond
50	19.8	7.4	0.4	62.0	Hollow ground diamond
55	19.9	8.8	0.4	75.9	Hollow ground diamond
100	17.5	8.2	0.3	64.0	Hollow ground diamond
150	15.9	7.3	0.2	53.4	Hollow ground diamond
200	14.2	6.5	0.1	44.1	Hollow ground diamond
250	9.7	5.2	0.0	25.2	Diamond

Table 13: Blade measurements of object 6, dagger
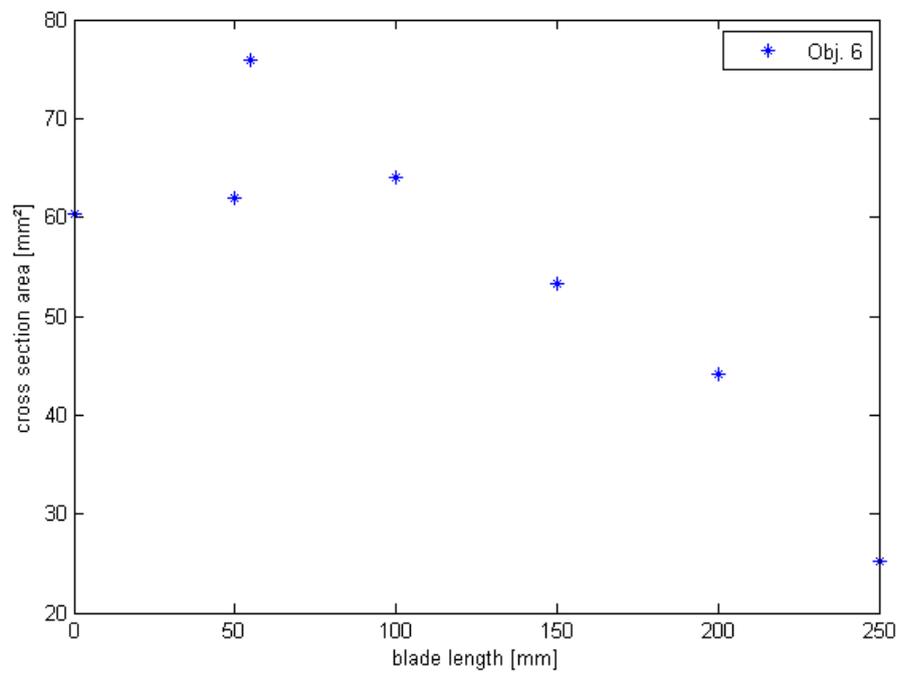
Figure 45: Cross Section of Object 6

A one–handed sword, presumably an offhand weapon for dual sword fencing, as used in the famous duels of Ascanio della Corgna, one of them depicted in a fresco in palazzo della Corgna. Combining this information with the dating of [Norman, 1980], the sword can be placed in the middle of the 16th century. The short and light blade is of diamond cross section, the hilt consists of lozenge shaped quillons and a big side ring with engraved decoration. The wooden grip bears marks of a former wire wrap with a crosswise pattern, the pommel is onion shaped with six bevels.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 10
- *Inner Guard*: None
- *Pommel*: Type 19

Figure 46: Object 7 – Hilt and forte outside view

Figure 47: Object 7 – Hilt oblique outside view

Figure 48: Object 7 – Hilt rear oblique view

Figure 49: Object 7 – Debole and point

	Object 7		
Overall length [mm]	854		
Blade length [mm]	740		
Overall mass [g]	583		
Point of balance [mm]	109		
Pommel length [mm]	51.5		
Pommel width [mm]	38		
Pommel thickness [mm]	32.5		
Pommel neck length [mm]	7		
Grip length [mm]	63.5		
Grip shape	rectangle, conical		
Grip material	wood		
	Distance [mm]	0	63.5
Measurements Grip	Width [mm]	20.5	18.0
	Thickness [mm]	18.0	17.5
Quillon block length [mm]	34.5		
Quillon block thickness [mm]	15.5		
Quillon block width [mm]	24.0		
Ring width [mm]	82		
Ring height[mm]	14		
Hilt depth [mm]	55		
Crossguard length	140		
Crossguard shape	rectangle		
Crossguard diameter [mm]	7 x 5		
Blade shape	diamond		

Table 14: Overview of the measurement parameters of object 7

Figure 50: Object 7 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	A [mm^2]	Blade shape
0	25.6	6.2	79.4	Diamond
100	20.8	5.3	55.1	Diamond
200	19.7	4.7	46.3	Diamond
300	18.4	4.5	41.4	Diamond
400	16.8	4.2	35.3	Diamond
500	15.7	3.8	29.8	Diamond
600	14.6	3.6	26.3	Diamond
700	12.2	3.1	18.9	Diamond

Table 15: Blade measurements of object 7, one-handed sword
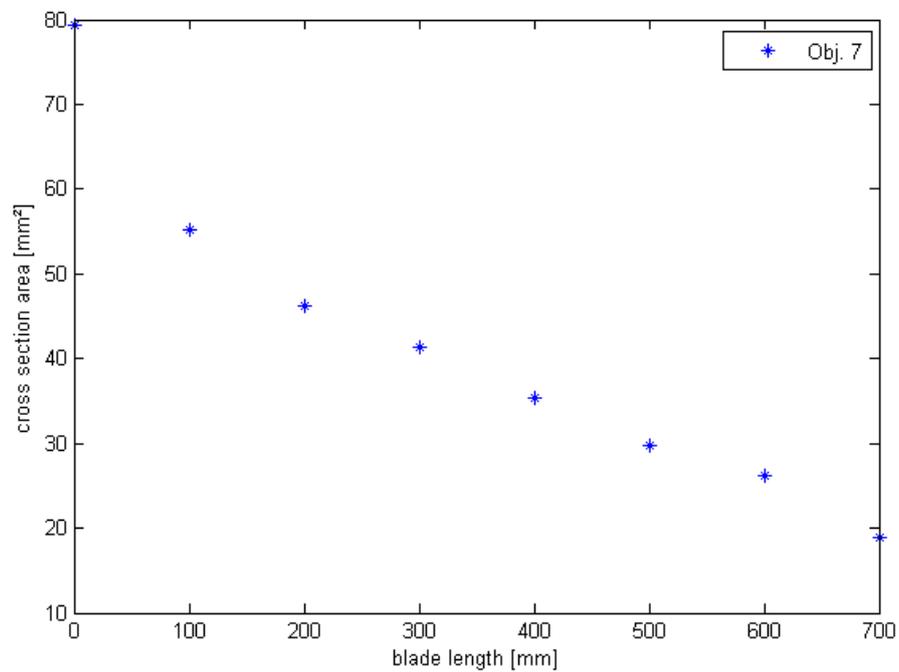
Figure 51: Cross Section of Object 7

Object 8 is a one–handed sword with a wide, thin blade that transitions from rectangular, over triangular to lenticular shape along its length. Its three fullers span the entire blade length. The asymetrical hilt is made up of hilt arms, two side rings and a knuckle bar of round cross section. The wooden grip tapers toward the pommel and is inlaid with iron bars and topped off with turks–head knots, the spherical pommel is decorated with a flower motif. It can be dated to 1500-1540.

Classification according to [Norman, 1980]:

- *Outer Guard*: Similar to type 44
- *Inner Guard*: None
- *Pommel*: Type 11

Figure 52: Object 8 – Hilt and forte outside view

Figure 53: Object 8 – Hilt oblique outside view

Figure 54: Object 8 – Hilt rear oblique view

Figure 55: Object 8 – Debole and point

	Object 8			
Overall length [mm]	1106			
Blade length [mm]	981			
Overall mass [g]	1170			
Point of balance [mm]	143			
Pommel length [mm]	41.5			
Pommel width [mm]	48			
Pommel thickness [mm]	43.5			
Grip length [mm]	79			
Grip shape	oval			
Grip material	wood with small inserted metal rods			
Measurements Grip	Distance [mm]	0	40	79
	Width [mm]	25.5	26.5	21.0
	Thickness [mm]	22.0	25.0	20.0
Quillon block length [mm]	8			
Quillon block thickness [mm]	19.5			
Hilt height front of crossguard [mm]	55.5			
Hilt height rear of crossguard [mm]	106			
Lower Ring width [mm]	102			
Upper Ring width [mm]	71			
Hilt width [mm]	118			
Hilt depth [mm]	70			
Crossguard shape	round			
Crossguard diameter [mm]	5.5 to 6.0			
Fuller length [mm]	until point			
Fuller count	3			
Blade shape	rectangle until 65mm, triangle until 791mm, rest lenticular			

Table 16: Overview of the measurement parameters of object 8

Figure 56: Object 8 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	wf1 [mm]	df1 [mm]	wf2 [mm]	df2 [mm]	A [mm²]	Blade shape
0	33.7	5.2	9.0	0.5	7.5	0.5	158.2	Rectangle
100	32.5	4.9	10.5	1.2	0.0	0.0	45.7	Triangle
200	31.5	4.7	9.0	0.9	0.0	0.0	52.3	Triangle
300	30.4	4.5	9.0	0.8	0.0	0.0	49.1	Triangle
400	29.7	4.5	9.0	1.0	0.0	0.0	42.6	Triangle
500	29.6	4.2	9.0	0.9	0.0	0.0	40.4	Triangle
600	29.5	3.9	9.0	0.8	0.0	0.0	38.2	Triangle
700	29.1	3.3	9.0	0.5	0.0	0.0	36.0	Triangle
800	27.8	2.6	6.5	0.4	0.0	0.0	41.3	Lenticular
900	26.2	2.0	5.0	0.4	0.0	0.0	29.6	Lenticular
950	22.5	1.6	3.5	0.3	0.0	0.0	21.2	Lenticular

Table 17: Blade measurements of object 8, one-handed sword
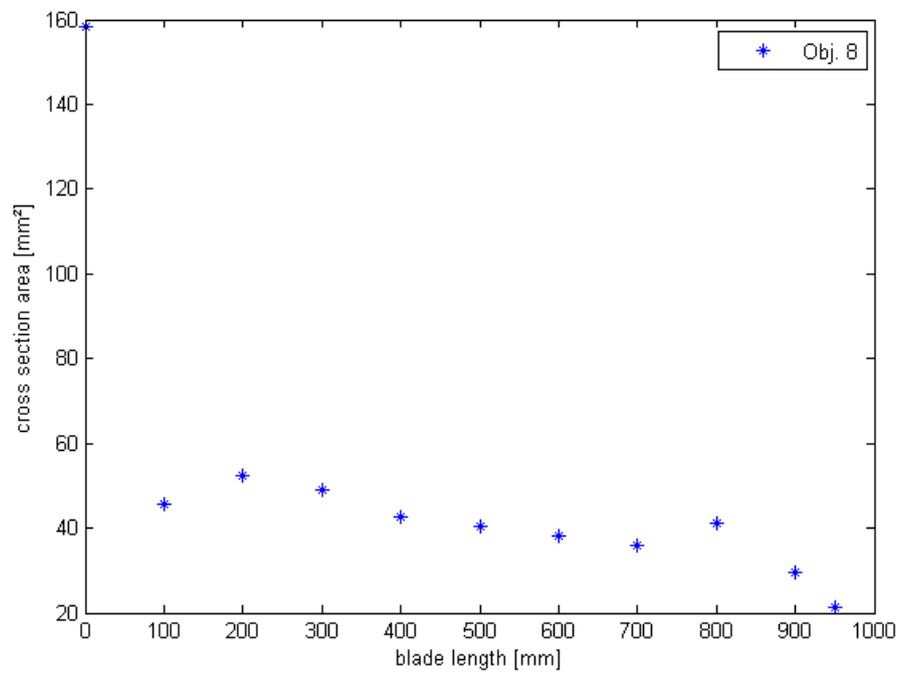
Figure 57: Cross Section of Object 8

A one–handed sword with a diamond shaped blade with a cutout for the index finger at the ricasso. The hilt consists of a curved rear quillon, knuckle guard and a forward hilt arm. The wooden grip has grooves in spiral pattern, covered in black leather. The oval flat disc–shaped pommel is cut out on one side to accomodate the knuckle bar.

Classification according to [Norman, 1980]:

- *Outer Guard*: Similar to type 4, 6 and 8
- *Inner Guard*: None
- *Pommel*: No match

Figure 58: Object 9 – Hilt and forte outside view

Figure 59: Object 9 – Hilt oblique outside view
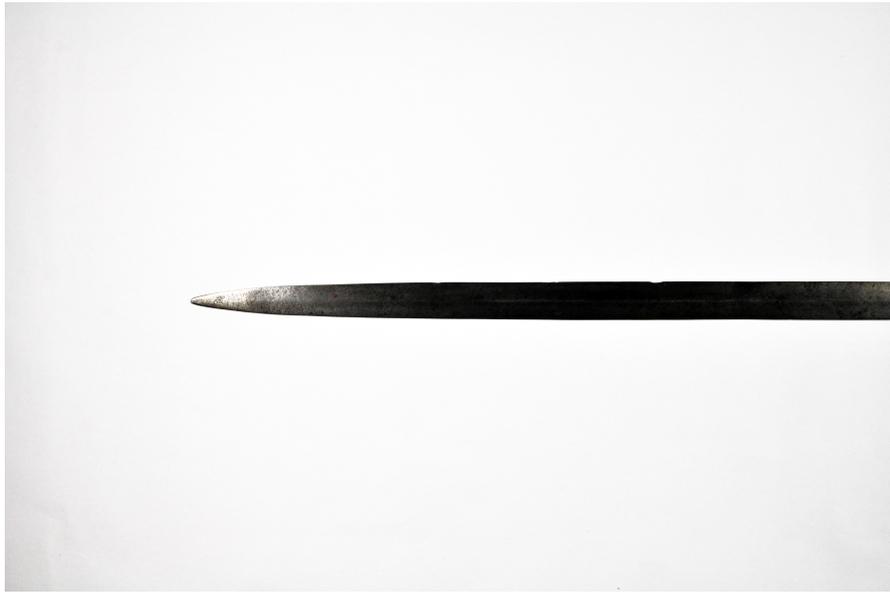
Figure 60: Object 9 – Debole and point

	Object 9		
Overall length [mm]	897		
Blade length [mm]	765		
Overall mass [g]	690		
Point of balance [mm]	145		
Pommel length [mm]	59		
Pommel width [mm]	49.3		
Pommel thickness [mm]	21.5 to 12.6		
Pommel neck length [mm]	11		
Grip length [mm]	73		
Grip shape	oval		
Grip material	wood and leather		
	Distance [mm]	0	73
Measurements Grip	Width [mm]	25	21
	Thickness [mm]	18.5	16.5
Quillon block length [mm]	7.5		
Quillon block thickness [mm]	19.5		
Quillon block width [mm]	59		
Hilt height front of crossguard [mm]	43.5		
Hilt height rear of crossguard [mm]	95		
Hilt width [mm]	152		
Crossguard shape	square		
Crossguard diameter [mm]	8 x 5		
Blade shape	diamond, with cutout for finger, length of cutout 21mm		

Table 18: Overview of the measurement parameters of object 9

Figure 61: Object 9 – Total view

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l_b [mm]	w_b [mm]	d_b [mm]	A [mm^2]	Blade shape
0	31.0	4.7	72.9	Diamond
20	25.3	4.7	59.5	Diamond
30	32.1	4.6	73.8	Diamond
100	31.6	4.5	71.1	Diamond
200	31.0	4.3	66.7	Diamond
300	30.8	4.0	61.6	Diamond
400	30.5	3.8	58.0	Diamond
500	29.4	3.1	45.6	Diamond
600	27.9	2.7	37.7	Diamond
700	22.3	2.0	22.3	Diamond
750	11.4	1.6	9.1	Diamond

Table 19: Blade measurements of object 9, one-handed sword
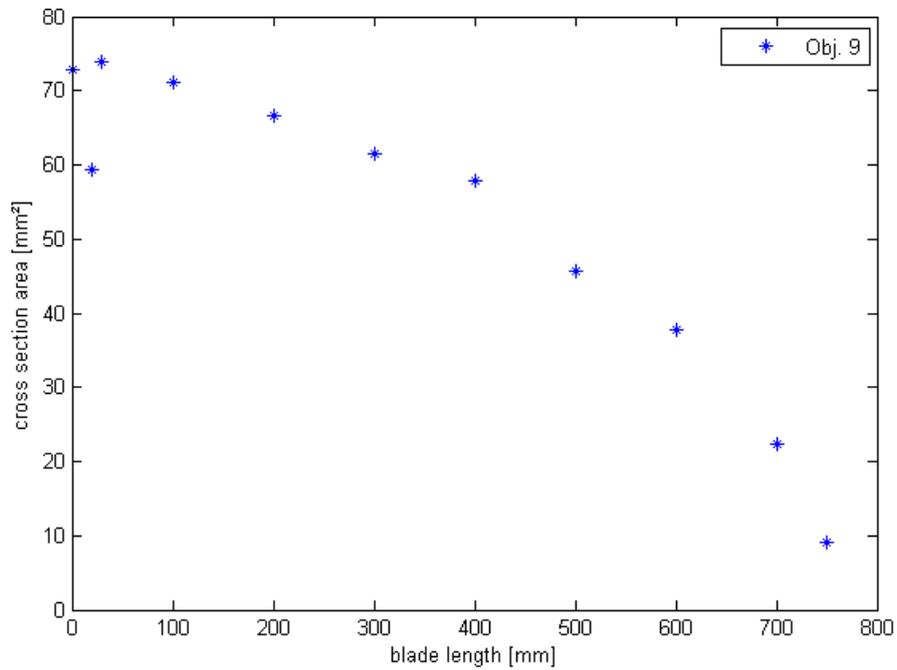
Figure 62: Cross Section of Object 9

Object 10 is a one–handed sword with a long narrow blade of hexagonal cross section. The delicate hilt is asymmetrical and consists of quillions, knuckle guard, hilt arms and an "M" shaped side ring, a tapering grip wrapped with wire and turks–head knots and a round pommel. It can be dated to the first half of the 16th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 41
- *Inner Guard*: None
- *Pommel*: Type 12

Figure 63: Object 10 – Hilt and forte outside view

Figure 64: Object 10 – Hilt and forte side view

Figure 65: Object 10 – Hilt oblique outside view

Figure 66: Object 10 – Hilt rear oblique view

Figure 67: Object 10 – Debole and point

	Object 10		
Overall length [mm]	1136		
Blade length [mm]	1004		
Overall mass [g]	1108		
Point of balance [mm]	166		
Pommel length [mm]	48		
Pommel width [mm]	51		
Pommel thickness [mm]	33		
Grip length [mm]	84.5		
Grip shape	oval, conical		
Grip material	wood with metal wire		
	Distance [mm]	0	84.5
Measurements Grip	Width [mm]	26.0	20.0
	Thickness [mm]	19.0	17.0
Quillon block length [mm]	9, point 34		
Quillon block thickness [mm]	18		
Quillon block width [mm]	13		
Hilt height front of crossguard [mm]	48		
Hilt height rear of crossguard [mm]	111		
Hilt depth outside [mm]	40		
Crossguard length	195		
Crossguard shape	round		
Crossguard diameter [mm]	5.5		
Fuller length [mm]	315		
Fuller count	1		
Blade shape	rectangle to 49mm, hexagonal to tip		

Table 20: Overview of the measurement parameters of object 10
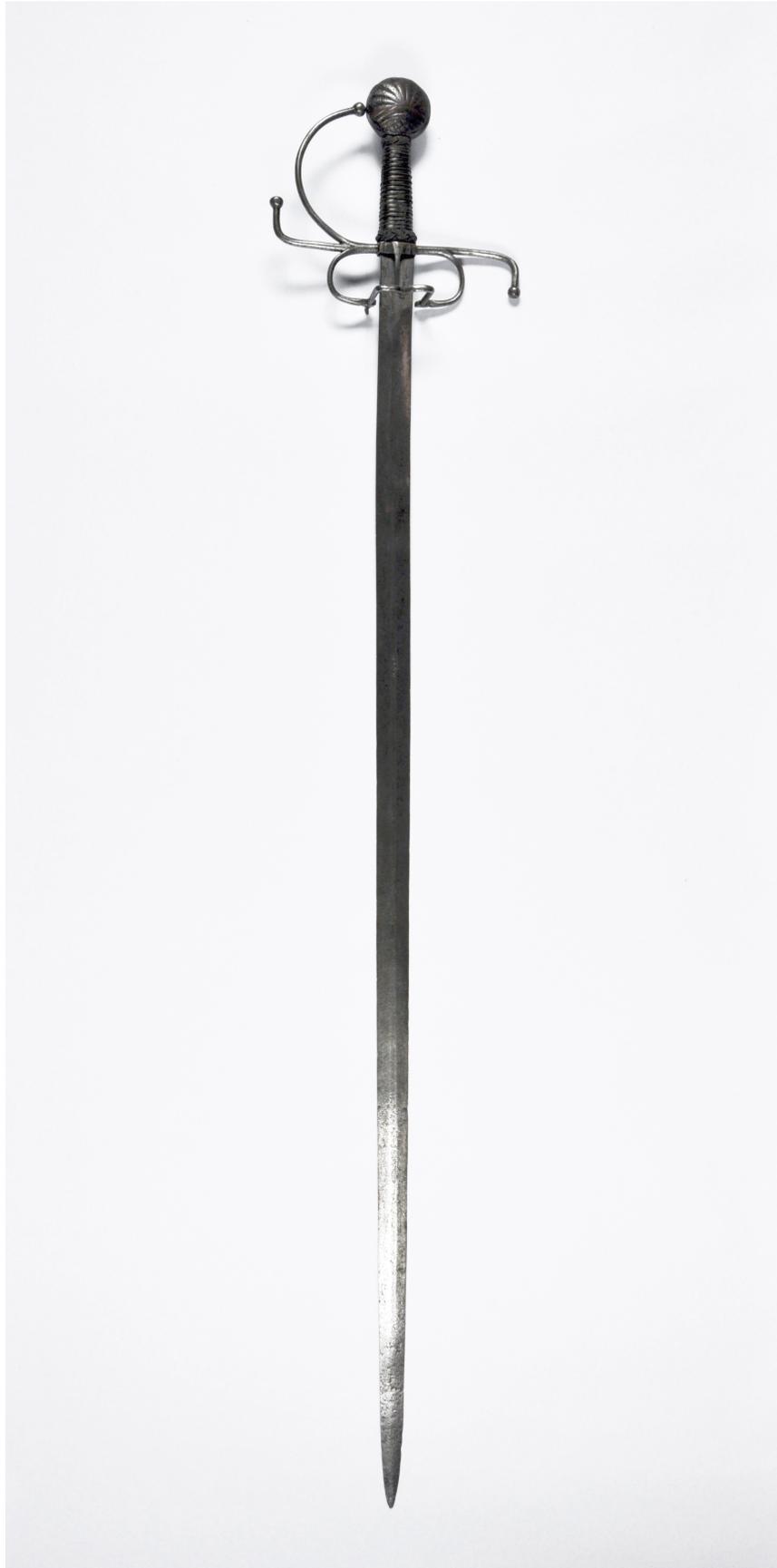
Figure 68: Object 10 – Total view

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l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	26.5	6.5	0.0	6.5	0.7	166.1	Rectangle
100	25.7	4.9	7.5	5.0	0.3	79.3	Hexagon
200	26.3	4.9	7.5	5.0	0.3	80.8	Hexagon
300	25.9	4.8	7.5	4.3	0.4	77.9	Hexagon
400	25.7	5.0	7.5	0.0	0.0	83.0	Hexagon
500	25.1	4.7	7.5	0.0	0.0	76.6	Hexagon
600	24.6	4.5	6.5	0.0	0.0	70.0	Hexagon
700	23.7	4.0	6.5	0.0	0.0	60.4	Hexagon
800	22.5	3.4	6.0	0.0	0.0	48.5	Hexagon
900	19.3	2.5	5.5	0.0	0.0	31.0	Hexagon
970	14.2	2.1	2.5	0.0	0.0	17.5	Hexagon

Table 21: Blade measurements of object 10, one-handed sword
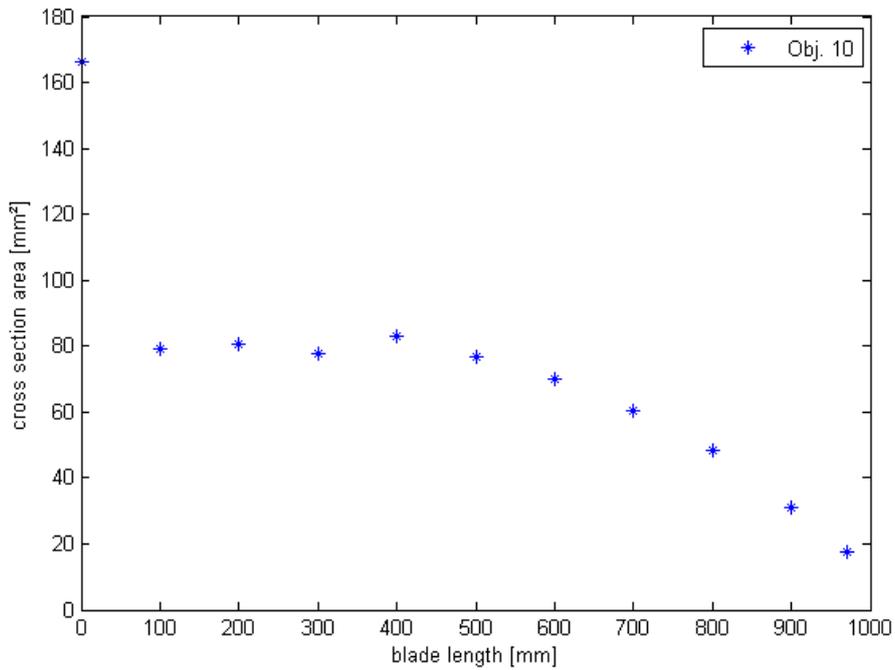
Figure 69: Cross Section of Object 10

A rapier with a long and slender blade that transitions from hexagonal to lenticular along its length with one central fuller. The swept hilt is made up of elegantly curved bars with scroll decoration, a wire bound grip of untypical hexagonal cross section with turks–head knots and a fluted onion shaped pommel with a hexagonal base. It can be dated to the middle of the 16th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 29
- *Inner Guard*: Similar to type 7
- *Pommel*: Similar to type 50 and 51

Figure 70: Object 11 – Hilt and forte inside view

Figure 71: Object 11 – Hilt and forte side view

Figure 72: Object 11 – Hilt oblique outside view

Figure 73: Object 11 – Hilt front oblique view

Figure 74: Object 11 – Debole and point

Figure 75: Object 11 – Total view

	Object 11
Overall length [mm]	1050
Blade length [mm]	921
Overall mass [g]	1045
Point of balance [mm]	122
Pommel length [mm]	49
Pommel width [mm]	48.5
Pommel thickness [mm]	42.5
Pommel neck length [mm]	14.5
Grip length [mm]	77.5
Grip shape	hexagonal
Grip material	

Measurements Grip	Distance [mm]	0	77.5
	Width [mm]	22.5	22.0
	Thickness [mm]	20.0	18.0

Quillon block length [mm]	10.5, middle 19.5
Quillon block thicness [mm]	13.5, middle 18.0
Hilt height front of crossguard [mm]	50
Hilt height rear of crossguard [mm]	94
Hilt width [mm]	126
Hilt depth outside [mm]	54.0
Hilt depth inside [mm]	44.5
Crossguard shape	half diamond
Crossguard diameter [mm]	3 to 5 x 8.5 to 18.5
Fuller length [mm]	from 49 to 205
Fuller count	1
Blade shape	rectangle to 50, hexagon to 205, rest lenticular

Table 22: Overview of the measurement parameters of object 11

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	21.0	7.8	0.0	0.0	0.0	163.8	Rectangle
45	22.4	7.5	0.0	0.0	0.0	168.0	Rectangle
50	26.3	7.3	4.9	4.9	2.1	98.3	Hexagon
100	24.0	6.4	4.9	4.9	1.5	82.0	Hexagon
200	21.6	5.8	3.0	3.0	0.5	69.3	Hexagon
300	20.2	5.6	0.0	0.0	0.0	76.6	Lenticular
400	19.2	4.9	0.0	0.0	0.0	63.5	Lenticular
500	17.7	4.4	0.0	0.0	0.0	52.6	Lenticular
600	16.5	4.0	0.0	0.0	0.0	44.5	Lenticular
700	15.8	3.9	0.0	0.0	0.0	41.6	Lenticular
800	15.1	3.6	0.0	0.0	0.0	36.6	Lenticular
900	11.9	2.8	0.0	0.0	0.0	22.5	Lenticular

Table 23: Blade measurements of object 11, one-handed sword
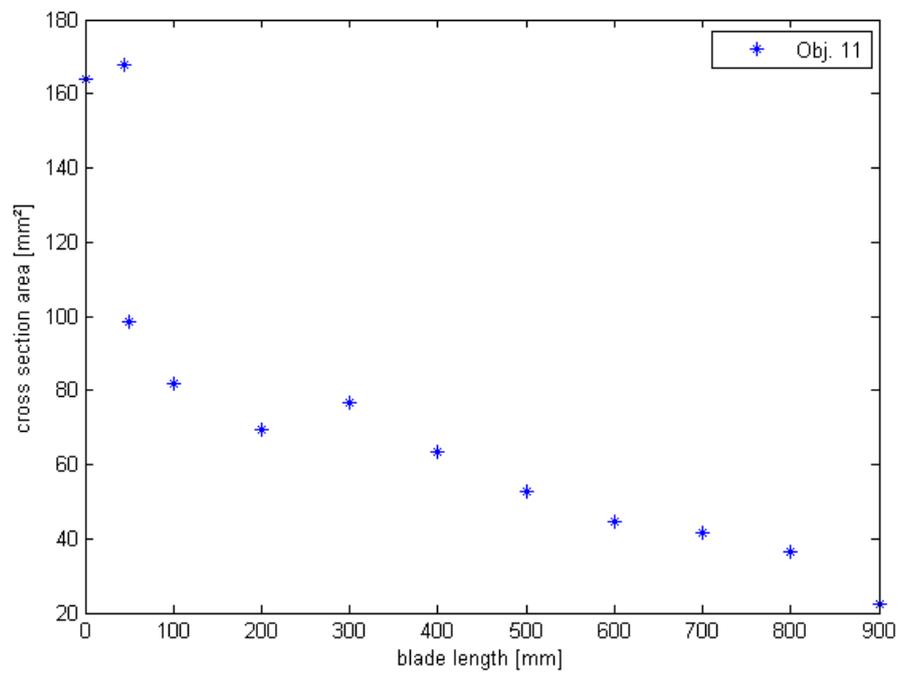
Figure 76: Cross Section of Object 11

A rapier with a very narrow, stiff blade with diamond cross section from Caino. The swept hilt of north Italian style is made up of a upward curved rear quillon, knuckle guard, hilt arms, counter–guard, loop guard and a forward guard of two short curved bars, all decorated with a pattern of ring-shaped punch–imptressions. The oval grip is wire–bound, the pommel rather small of fluted cylindrical shape. This rapier can be dated to the beginning of the 17th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 27
- *Inner Guard*: Type 29
- *Pommel*: Type 38

Figure 77: Object 12 – Hilt and forte outside view

Figure 78: Object 12 – Hilt and forte side view

Figure 79: Object 12 – Hilt oblique inside view

Figure 80: Object 12 – Ricasso oblique view

Figure 81: Object 12 – Hilt front oblique view

Figure 82: Object 12 – Debole and point

Figure 83: Object 12 – Total view

	Object 12		
Overall length [mm]	1180		
Blade length [mm]	1047		
Overall mass [g]	1130		
Point of balance [mm]	190		
Pommel length [mm]	59		
Pommel width [mm]	33		
Pommel thickness [mm]	27.5		
Pommel neck length [mm]	8		
Grip length [mm]	72		
Grip shape	oval		
Grip material			
Measurements Grip	Distance [mm]	0	72
	Width [mm]	23.5	19.5
	Thickness [mm]	20.0	21.0
Quillon block length [mm]	23.5		
Quillon block thickness [mm]	18.0		
Quillon block width [mm]	25.5		
Hilt height front of crossguard [mm]	65.5		
Hilt height rear of crossguard [mm]	118		
Hilt width [mm]	146		
Hilt depth outside [mm]	64		
Hilt depth inside [mm]	54		
Crossguard shape	oval, almost lenticular		
Crossguard diameter [mm]	8.5 x 5.0		
Blade shape	rectangle to 65, diamond to point		

Table 24: Overview of the measurement parameters of object 12

l_b [mm]	w_b [mm]	d_b [mm]	A [mm^2]	Blade shape
0	17.0	9.6	163.2	Rectangle
55	19.0	8.6	163.4	Rectangle
65	23.1	8.8	101.6	Diamond
100	21.5	8.2	88.2	Diamond
200	20.3	8.1	82.2	Diamond
300	18.9	8.1	76.5	Diamond
400	18.1	7.3	66.1	Diamond
500	17.1	7.0	59.9	Diamond
600	16.8	6.7	56.3	Diamond
700	15.9	6.7	53.3	Diamond
800	15.0	6.4	48.0	Diamond
900	13.7	5.7	39.0	Diamond
1000	11.7	4.7	27.5	Diamond

Table 25: Blade measurements of object 12, one-handed sword
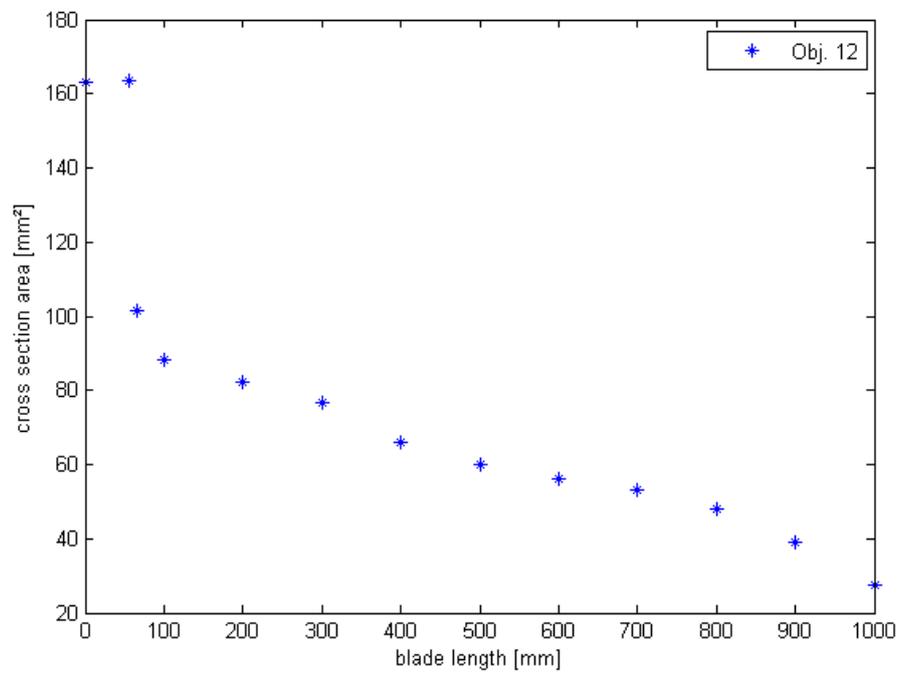
Figure 84: Cross Section of Object 12

IV.13.   Object 13

A rapier with a long stiff thrusting blade, made in Caino, of hexagonal cross section with a central fuller. The hilt consists of straight quillons, hilt arms, side ring, two loop guards, knuckle guard and counter–guard all made of round bars. The oval flattened grip is wire–bound with turks–head knots, the pommel of flattened cylindrical section. It can be dated to the late 16th / early 17th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 74
- *Inner Guard*: Type 30
- *Pommel*: Similar to type 32

Figure 85: Object 13 – Hilt and forte outside view

Figure 86: Object 13 – Hilt and forte side view

Figure 87: Object 13 – Hilt oblique outside view

Figure 88: Object 13 – Hilt rear oblique view

Figure 89: Object 13 – Debole and point

	Object 13		
Overall length [mm]	1235		
Blade length [mm]	1098		
Overall mass [g]	1080		
Point of balance [mm]	131		
Pommel length [mm]	53		
Pommel width [mm]	36.0		
Pommel thickness [mm]	32.5		
Pommel neck length [mm]	9		
Grip length [mm]	83.5		
Grip shape	oval, sides flattened		
Grip material	metal wire		
	Distance [mm]	0	83.5
Measurements Grip	Width [mm]	24.5	21.5
	Thickness [mm]	19.0	20.5
Quillon block length [mm]	19.0		
Quillon block thickness [mm]	16.0		
Quillon block width [mm]	24.0		
Hilt height front of crossguard [mm]	70		
Hilt height rear of crossguard [mm]	96		
Hilt width [mm]	217		
Hilt depth outside [mm]	65		
Hilt depth inside [mm]	55		
Crossguard shape	round		
Crossguard diameter [mm]	5.5 to 6		
Fuller length [mm]	from 63.5 to 268		
Fuller count	1		
Blade shape	rectangle to 64, hexagon to point		

Table 26: Overview of the measurement parameters of object 13

Figure 90: Object 13 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	17.2	10.0	0.0	0.0	0.0	172.0	Rectangle
60	19.2	8.3	0.0	0.0	0.0	159.4	Rectangle
64	22.4	7.9	9.0	5.0	2.1	108.2	Hexagon
100	21.5	7.5	8.0	5.0	1.9	96.6	Hexagon
200	20.4	7.0	6.5	4.5	1.3	85.9	Hexagon
300	19.0	6.3	5.0	0.0	0.0	75.6	Hexagon
400	17.6	5.0	4.5	0.0	0.0	55.3	Hexagon
500	16.6	4.6	4.5	0.0	0.0	48.5	Hexagon
600	15.1	4.0	4.5	0.0	0.0	39.2	Hexagon
700	14.3	3.8	4.0	0.0	0.0	34.8	Hexagon
800	13.8	3.5	3.5	0.0	0.0	30.3	Hexagon
900	12.7	3.0	3.0	0.0	0.0	23.6	Hexagon
1000	11.9	2.6	1.5	0.0	0.0	17.4	Hexagon
1070	8.1	1.6	1.5	0.0	0.0	7.7	Hexagon

Table 27: Blade measurements of object 13, one-handed sword
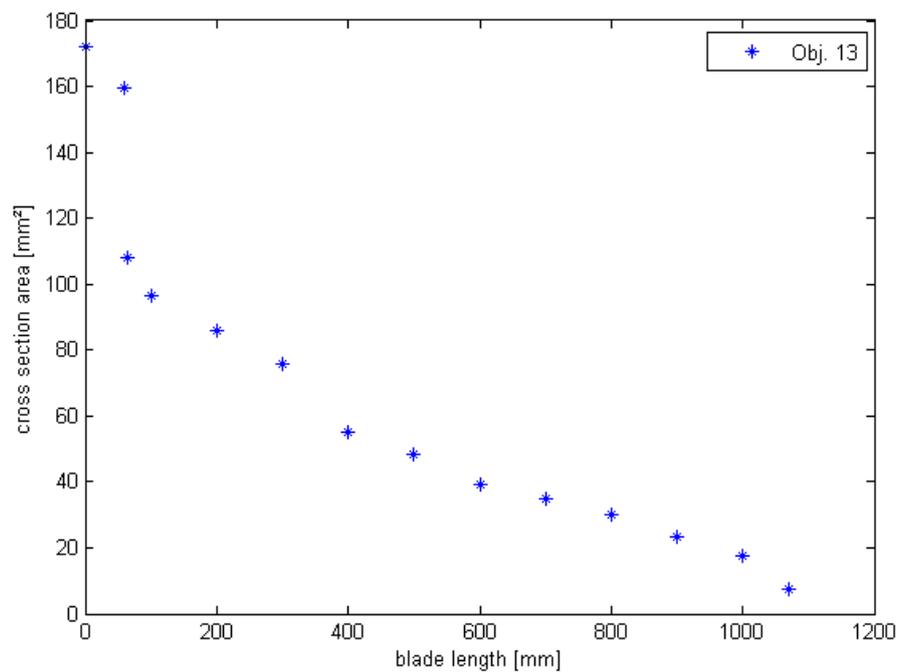
Figure 91: Cross Section of Object 13

IV.14. OBJECT 14

A rapier with a long stiff and narrow blade of hexagonal section with a lenticular debole and a central fuller. The hilt is made up of flat bars consisting of a sideways curved rear quillon, knuckle guard, hilt arms, side ring, loop guard and counter–guard. The slightly oval grip is spirally fluted and wire–bound with added turks–head knots, the pommel a plain, flattened cylindrical shape. It can be dated to the late 16th / early 17th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 57
- *Inner Guard*: Type 30
- *Pommel*: Similar to Type 32

Figure 92: Object 14 – Hilt and forte outside view

Figure 93: Object 14 – Hilt and forte side view

Figure 94: Object 14 – Hilt oblique outside view

Figure 95: Object 14 – Debole and point

Figure 96: Object 14 – Total view

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	Object 14		
Overall length [mm]	1213		
Blade length [mm]	1074		
Overall mass [g]	1250		
Point of balance [mm]	117		
Pommel length [mm]	61		
Pommel width [mm]	37		
Pommel thickness [mm]	31		
Pommel neck length [mm]	10		
Grip length [mm]	78		
Grip shape	oval		
Grip material	wood with metal wire		
Measurements Grip	Distance [mm]	0	78
	Width [mm]	28.5	19.5
	Thickness [mm]	21.0	19.0
Quillon block length [mm]	23		
Quillon block thickness [mm]	19		
Quillon block width [mm]	28		
Hilt height front of crossguard [mm]	68		
Hilt height rear of crossguard [mm]	105		
Hilt width [mm]	140		
Hilt depth outside [mm]	65		
Hilt depth inside [mm]	60		
Crossguard shape	lenticular		
Crossguard width [mm]	10.0		
Crossguard thickness [mm]	4.5 to 5.5		
Fuller length [mm]	240		
Fuller count	1		
Blade shape	rectangle to 71, hexagon to 880, rest lenticular		

Table 28: Overview of the measurement parameters of object 14

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	20.0	8.8	0.0	5.5	0.7	170.8	Rectangle
68	22.4	8.0	0.0	5.8	0.6	174.5	Rectangle
71	22.4	8.0	8.0	5.8	0.6	116.9	Hexagon
100	22.5	7.5	7.5	5.0	0.5	109.1	Hexagon
200	20.9	6.6	6.0	5.0	0.5	85.4	Hexagon
300	19.1	6.0	4.5	0.0	0.0	70.8	Hexagon
400	17.1	5.4	4.5	0.0	0.0	58.3	Hexagon
500	16.3	5.0	4.0	0.0	0.0	50.8	Hexagon
600	15.2	4.5	4.0	0.0	0.0	43.2	Hexagon
700	14.4	4.4	4.0	0.0	0.0	40.5	Hexagon
800	13.3	4.0	3.5	0.0	0.0	33.6	Hexagon
900	12.4	3.5	0.0	0.0	0.0	29.4	Lenticular
1000	10.8	2.5	0.0	0.0	0.0	18.2	Lenticular
1050	7.9	1.5	0.0	0.0	0.0	8.0	Lenticular

Table 29: Blade measurements of object 14, one-handed sword
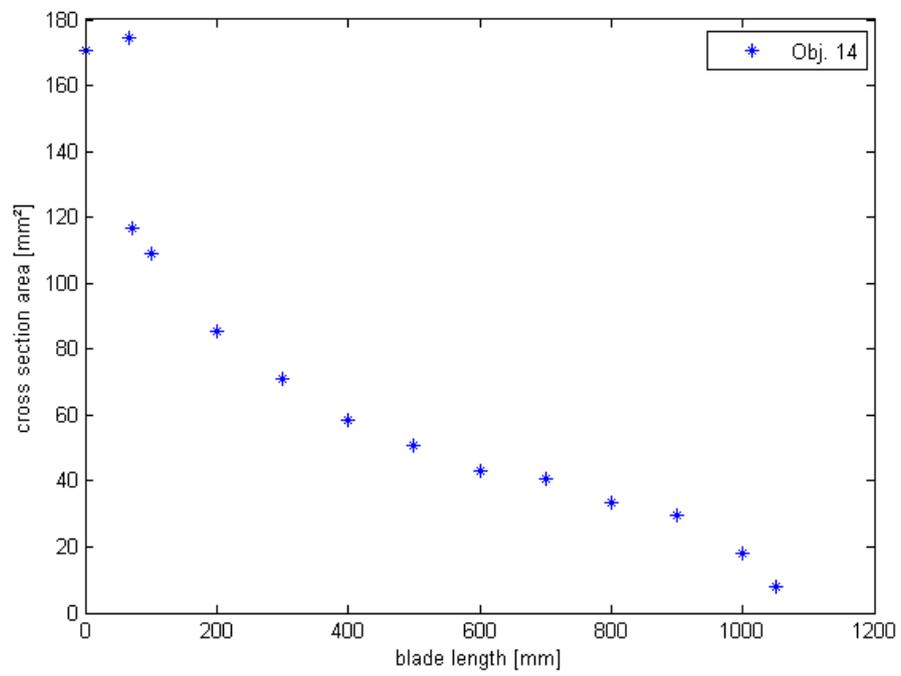
Figure 97: Cross Section of Object 14

Object 15 is a rapier with a very long and stiff blade, made in Caino, of hexagonal section with one central fuller that runs almost the full length of the blade. The complex hilt consists of straight quillons, hilt arms, a three ring outer guard, knuckle guard and counter–guard. The grip has oval section and tapers at both ends. It is bound with wire and finished with turks–head knots. The pommel is of ovoid shape with a pronounced button. It can be dated to the early 17th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 61
- *Inner Guard*: Type 35
- *Pommel*: Similar to type 29
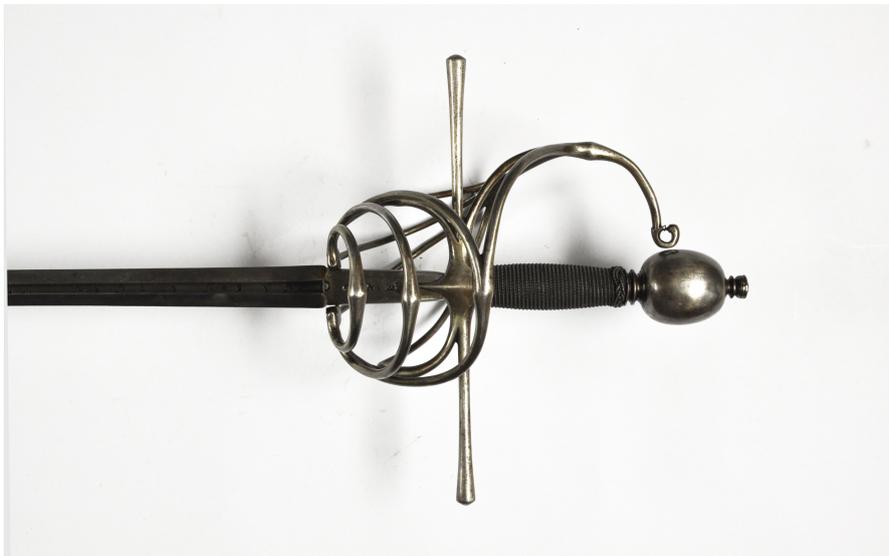
Figure 98: Object 15 – Hilt and forte outside view

Figure 99: Object 15 – Hilt and forte side view

Figure 100: Object 15 – Hilt and forte inside view

Figure 101: Object 15 – Hilt oblique outside view

Figure 102: Object 15 – Debole and point

	Object 15		
Overall length [mm]	1290		
Blade length [mm]	1142		
Overall mass [g]	1330		
Point of balance [mm]	118		
Pommel length [mm]	66		
Pommel width [mm]	40.5		
Pommel thickness [mm]	41.5		
Pommel neck length [mm]	10.5		
Grip length [mm]	79		
Grip shape	oval		
Grip material			
Measurements Grip	Distance [mm] 0 40 79		
	Width [mm] 22.5 25.0 20.5		
	Thickness [mm] 20.5 23.0 20.0		
Quillon block length [mm]	15.5, point 33		
Quillon block thickness [mm]	hilt 18.5, ricasso 13.5		
Hilt height front of crossguard [mm]	76		
Hilt height rear of crossguard [mm]	110		
Hilt width [mm]	242		
Hilt depth outside [mm]	73		
Hilt depth inside [mm]	67		
Crossguard shape	round, slightly oval		
Crossguard diameter [mm]	outside 6 thinnest; inside 4.2		
Fuller length [mm]	from 78 to 980		
Fuller count	1		
Blade shape	rectangle to 78, hexagon to 1040, diamond to point		

Table 30: Overview of the measurement parameters of object 15

Figure 103: Object 15 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	15.0	9.6	0.0	0.0	0.0	144.0	Rectangle
40	12.8	9.6	0.0	0.0	0.0	122.9	Rectangle
78	19.5	8.9	0.0	0.0	0.0	173.6	Rectangle
80	23.3	8.9	7.0	7.0	2.7	106.9	Hexagon
100	22.2	7.2	7.0	7.0	2.2	83.0	Hexagon
200	19.9	5.8	6.5	6.5	1.1	66.8	Hexagon
300	19.0	5.9	5.0	5.0	0.6	66.8	Hexagon
400	17.9	5.4	5.0	5.0	0.7	57.1	Hexagon
500	16.8	5.0	4.5	4.5	0.7	49.0	Hexagon
600	15.7	4.5	4.0	4.0	0.5	41.6	Hexagon
700	15.1	4.2	3.5	3.5	0.3	37.7	Hexagon
800	14.1	4.2	2.0	2.0	0.2	33.3	Hexagon
900	12.1	3.5	1.8	1.8	0.1	24.1	Hexagon
1000	11.1	3.2	0.5	0.0	0.0	18.6	Hexagon
1100	8.8	2.0	0.0	0.0	0.0	8.8	Diamond

Table 31: Blade measurements of object 15, one-handed sword
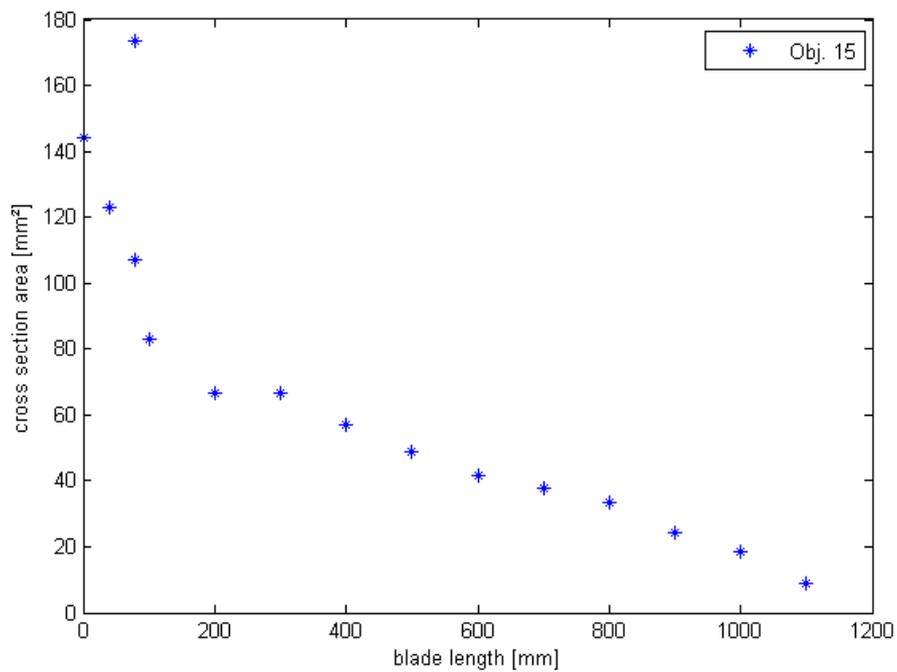
Figure 104: Cross Section of Object 15

A rapier with a heavy hexagonal blade with central fuller and a diamond section tip. The hilt is of ring guard type with the following components: a curved rear quillon, hilt arms, side ring with pierced plate, two ring guards, loop guard, knuckle guard and counter–guard. The grip is of octagonal section and unusually short, wire–bound with turks–head knots and a fluted cylindrical pommel. It can be dated to the early 17th century.

Classification according to [Norman, 1980]:

- *Outer Guard*: Type 61
- *Inner Guard*: Type 35
- *Pommel*: Similar to type 33

Figure 105: Object 16 – Hilt and forte outside view

Figure 106: Object 16 – Hilt and forte side view

Figure 107: Object 16 – Hilt and forte inside view

Figure 108: Object 16 – Hilt oblique outside view

Figure 109: Object 16 – Debole and point

Figure 110: Object 16 – Total view

	Object 16			
Overall length [mm]	1240			
Blade length [mm]	1098			
Overall mass [g]	1411			
Point of balance [mm]	127			
Pommel length [mm]	70			
Pommel width [mm]	42.5			
Pommel thickness [mm]	34.5			
Pommel neck length [mm]	10			
Grip length [mm]	69			
Grip shape	octagon			
Grip material				
Measurements Grip	Distance [mm]	0	35	69
	Width [mm]	24.5	27.0	22.0
	Thickness [mm]	23.5	26.5	21.5
Quillon block length [mm]	middle 28, sides 13			
Quillon block thickness [mm]	19			
Quillon block width [mm]	24			
Hilt height front of crossguard [mm]	72			
Hilt height rear of crossguard [mm]	94			
Hilt width [mm]	180			
Hilt depth outside [mm]	72			
Hilt depth inside [mm]	60			
Shell thickness [mm]	1.25			
Crossguard shape	hexagon			
Crossguard diameter [mm]	7.5 x 5.0			
Fuller length [mm]	280			
Fuller count	1			
Blade shape	rectangle to 72, hexagon to 900, diamond to point			

Table 32: Overview of the measurement parameters of object 16
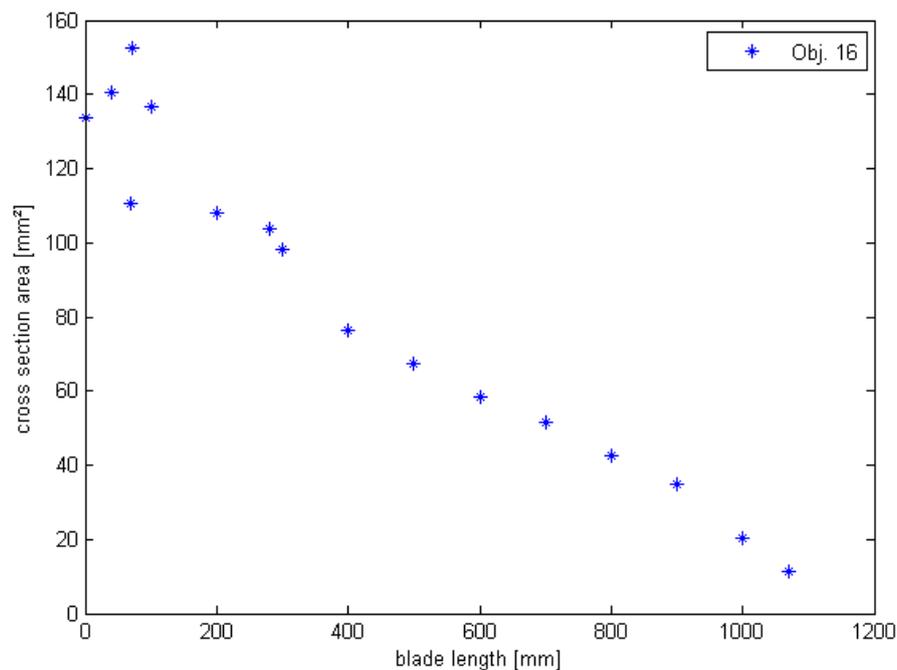
Figure 111: Cross Section of Object 16

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	de [mm]	A [mm^2]	Blade shape
0	22.0	8.5	0.0	5.0	2.0	5.0	133.6	Diamond with blunt edge
40	25.0	8.4	0.0	6.0	2.1	4.3	140.4	Diamond with blunt edge
70	23.0	8.1	0.0	6.5	2.2	3.3	110.4	Diamond with blunt edge
72	31.3	8.1	11.5	6.5	2.2	0.0	152.6	Hexagon
100	30.0	7.9	11.0	6.5	2.6	0.0	136.8	Hexagon
200	26.2	6.6	10.5	4.5	1.9	0.0	108.2	Hexagon
280	23.0	6.7	8.0	0.0	0.0	0.0	103.9	Hexagon
300	22.3	6.6	7.5	0.0	0.0	0.0	98.3	Hexagon
400	20.1	6.2	4.5	0.0	0.0	0.0	76.3	Hexagon
500	19.2	5.8	4.0	0.0	0.0	0.0	67.3	Hexagon
600	18.2	5.4	3.5	0.0	0.0	0.0	58.6	Hexagon
700	17.7	5.0	3.0	0.0	0.0	0.0	51.8	Hexagon
800	16.9	4.4	2.5	0.0	0.0	0.0	42.7	Hexagon
900	16.3	3.8	2.0	0.0	0.0	0.0	34.8	Hexagon
1000	14.0	2.9	0.0	0.0	0.0	0.0	20.3	Diamond
1070	11.0	2.1	0.0	0.0	0.0	0.0	11.6	Diamond

Table 33: Blade measurements of object 16, one-handed sword

A two–handed sword with a quite short, diamond cross section blade. The crossguard is straight with round section, the grip is missing, the pommel pear–shaped.

Figure 112: Object 17 – Crossguard and forte top view
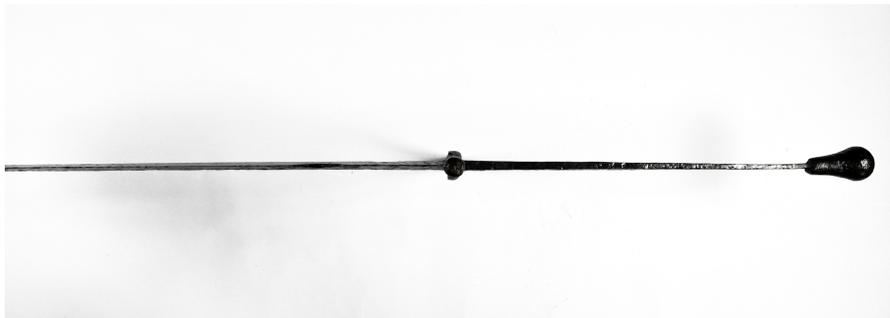
Figure 113: Object 17 – Crossguard and forte side view

Figure 114: Object 17 – Crossguard oblique view

Figure 115: Object 17 – Debole and point

Figure 116: Object 17 – Total view

	Object 17					
Overall length [mm]	1420					
Blade length [mm]	1015					
Overall mass [g]	2030					
Point of balance [mm]	171					
Pommel length [mm]	66					
Pommel width [mm]	35.5					
Pommel thickness [mm]	34.5					
Tang length [mm]	336					
Measurements tang	Distance [mm]	0	10	20	30	336
	Width [mm]	23	21	18	12	9.5
	Thickness [mm]	10	7.8	6.4	5.3	5.6
Quillon block length [mm]	14.5					
Quillon block thickness [mm]	28					
Crossguard length	335					
Crossguard shape	round					
Crossguard diameter [mm]	11					
Blade shape	diamond to point					

Table 34: Overview of the measurement parameters of object 17

l_b [mm]	w_b [mm]	d_b [mm]	A [mm^2]	Blade shape
0	47.5	10.1	239.9	Diamond
50	46.1	8.0	184.4	Diamond
100	46.7	7.8	182.1	Diamond
200	45.9	7.5	172.1	Diamond
300	44.4	7.1	157.6	Diamond
400	43.3	6.6	142.9	Diamond
500	41.6	6.5	135.2	Diamond
600	40.0	6.3	126.1	Diamond
700	38.2	5.8	110.8	Diamond
800	36.5	5.1	93.1	Diamond
900	33.4	4.9	81.8	Diamond
1000	24.0	3.9	46.8	Diamond

Table 35: Blade measurements of object 17, two-handed sword
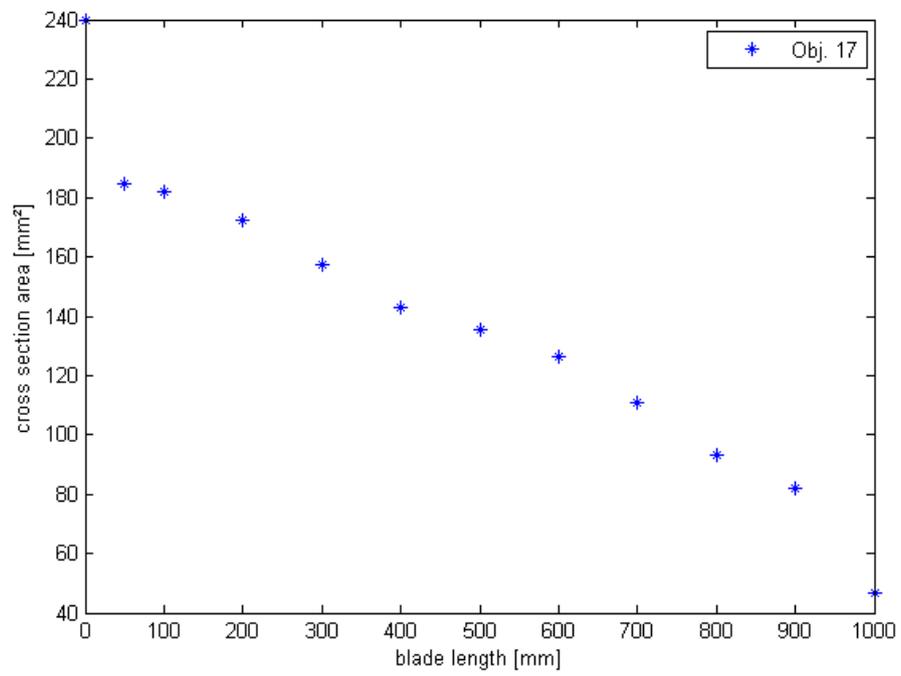
Figure 117: Cross Section of Object 17

This object is a one–and–a–half handed sword with a narrow, strongly tapering blade that transitions from hexagonal to diamond section along its length. The crossguard curves toward the blade and is of lenticular section, the grip is missing and the pommel is a chamfered disc shape.

Figure 118: Object 18 – Crossguard and forte top view

Figure 119: Object 18 – Forte and tang top view

Figure 120: Object 18 – Crossguard and forte side view

Figure 121: Object 18 – Crossguard oblique view

Figure 122: Object 18 – Debole and point

Figure 123: Object 18 – Total view

	Object 18				
Overall length [mm]	1255				
Blade length [mm]	983				
Overall mass [g]	1360				
Point of balance [mm]	161				
Pommel length [mm]	41.3				
Pommel width [mm]	48				
Pommel thickness [mm]	21.0 to 18.5				
Tang length [mm]	234				
Measurements tang	Distance [mm]	0	10	20	234
	Width [mm]	16.0	16.3	12.0	8.7
	Thickness [mm]	8.5	7.9	6.5	4.5
Quillon block length [mm]	14.5				
Quillon block thicness [mm]	25.0				
Crossguard length	193				
Crossguard shape	lenticular				
Crossguard diameter [mm]	15.5 x 6.5				
Blade shape	hexagon to 700, diamond to point				

Table 36: Overview of the measurement parameters of object 18

l_b [mm]	w_b [mm]	ws [mm]	d_b [mm]	A [mm^2]	Blade shape
0	35.5	11.5	10.0	235.0	Hexagon
100	31.9	11.0	9.0	193.1	Hexagon
200	28.5	9.5	9.0	171.0	Hexagon
300	26.6	9.0	8.9	158.4	Hexagon
400	24.5	8.5	8.4	138.6	Hexagon
500	22.8	7.0	8.1	120.7	Hexagon
600	21.1	5.5	7.9	105.1	Hexagon
700	17.8	2.5	7.5	76.1	Hexagon
800	15.0	0.0	6.7	50.3	Diamond
900	10.9	0.0	4.6	25.1	Diamond
950	8.0	0.0	4.2	16.8	Diamond

Table 37: Blade measurements of object 18, two-handed sword
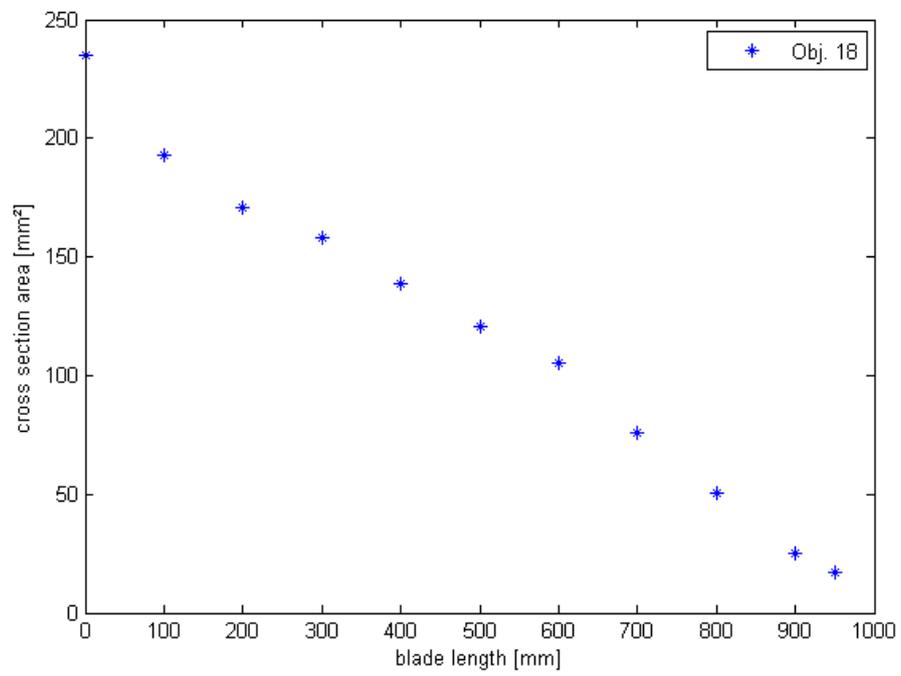
Figure 124: Cross Section of Object 18

A one–handed sword of a very rare type with a die–forged and hollowwhetted blade that is stiff and light. It is broken 60 cm from the hilt. The hilt is made up of straight quillons, hilt arms, interconnected side rings and a crossed–bar counter–guard. The oval wooden grip is partially covered with steel bars and end caps, the pommel is vase shaped.

Figure 125: Object 19 – Hilt and forte outside view

Figure 126: Object 19 – Hilt oblique outside view

Figure 127: Object 19 – Hilt oblique inside view

Figure 128: Object 19 – Debole and point

Figure 129: Object 19 – Total view
100

	Object 19			
Overall length [mm]	1183			
Blade length [mm]	1049			
Overall mass [g]	855			
Pommel length [mm]	51			
Pommel width [mm]	44.5			
Pommel thickness [mm]	43.0			
Grip length [mm]	82			
Grip shape	oval			
Grip material				
Measurements Grip	Distance [mm]	0	35	82
	Width [mm]	22.5	27.5	22.5
	Thickness [mm]	18.0	22.0	20.5
Quillon block length [mm]	23 middle, 12 sides			
Quillon block thickness [mm]	15			
Quillon block width [mm]	36.5			
Hilt height front of crossguard [mm]	52			
Hilt width [mm]	22.2			
Hilt depth outside [mm]	62			
Hilt depth inside [mm]	45			
Crossguard length				
Crossguard shape	round			
Crossguard diameter [mm]	5.5 to 3.5			
Fuller length [mm]	51			
Fuller depth [mm]	1.2			
Fuller length [mm]	19 to 27			
Fuller count	1			
Blade shape	rectangle to 57, hollow ground triangle to point; broken at 602			
Parrying hook length [mm]				
Parrying hook thickness [mm]				

Table 38: Overview of the measurement parameters of object 19

l_b [mm]	w_b [mm]	d_b [mm]	Blade shape
0	33.4	7.0	Hollow ground triangle
57	34.5	7.4	Hollow ground triangle
100	30.9	6.3	Hollow ground triangle
200	25.9	7.0	Hollow ground triangle
300	23.4	6.7	Hollow ground triangle
400	20.5	6.6	Hollow ground triangle
500	19.0	6.7	Hollow ground triangle
600	16.6	5.4	Hollow ground triangle
700	15.7	6.2	Hollow ground triangle
800	14.8	5.9	Hollow ground triangle
900	13.4	5.5	Hollow ground triangle
1000	11.2	4.9	Hollow ground triangle

Table 39: Blade measurements of object 19, one-handed sword

A rapier blade from Caino of diamond cross section, with a sligthly hollow–ground ricasso. Because the blade is unmounted, the shape of the tang can be clearly seen.

Figure 130: Object 20 – Forte and tang top view

Figure 131: Object 20 – Forte and tang side view

Figure 132: Object 20 – Forte and tang oblique view

	Object 20				
Overall length [mm]	1205				
Blade length [mm]	1082				
Overall mass [g]	480				
Point of balance [mm]	350				
Tang length [mm]	125				
Measurements tang	Distance [mm]	0	10	100	125
	Width [mm]	18.3	13.3	7.6	6.8
	Thickness [mm]	9.7	7.7	4.6	3.6
Fuller length [mm]	53				
Fuller number	1				
Blade shape	rectangle to 53, diamond to point				

Table 40: Overview of the measurement parameters of object 20

Figure 133: Object 20 – Total view

l_b [mm]	w_b [mm]	d_b [mm]	ws [mm]	wf [mm]	df [mm]	A [mm^2]	Blade shape
0	18.3	9.7	12.5	12.5	0.3	144.4	Rectangle
53	21.1	9.0	13.5	13.5	0.9	139.4	Rectangle
55	23.4	8.8	0.0	0.0	0.0	103.0	Diamond
100	21.3	7.4	0.0	0.0	0.0	78.8	Diamond
200	18.6	6.1	0.0	0.0	0.0	56.7	Diamond
300	16.8	6.0	0.0	0.0	0.0	50.4	Diamond
400	16.7	6.0	0.0	0.0	0.0	50.1	Diamond
500	16.4	5.6	0.0	0.0	0.0	45.9	Diamond
600	15.7	4.9	0.0	0.0	0.0	38.5	Diamond
700	14.7	4.7	0.0	0.0	0.0	34.5	Diamond
800	14.6	4.6	0.0	0.0	0.0	33.6	Diamond
900	14.0	4.0	0.0	0.0	0.0	28.0	Diamond
1000	13.2	3.5	0.0	0.0	0.0	23.1	Diamond
1050	12.6	2.9	0.0	0.0	0.0	18.3	Diamond

Table 41: Blade measurements of object 20, unmounted blade
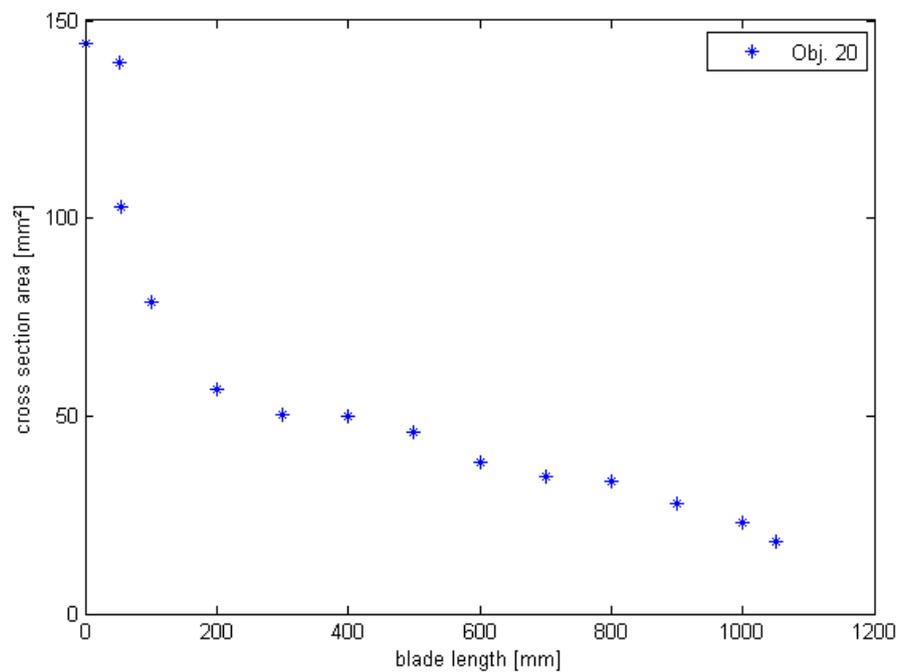
Figure 134: Cross Section of Object 20

V. Diagrams

Each object described above has been presented with a cross section progression diagram to get an idea of the assumable handling characteristic. Now we are going to combine those diagrams for comparison of those swords, grouped by type, which are one–handed and two–handed weapons. The diagrams of object 6 (dagger), 7, and 19 (broken blade) have been omitted.
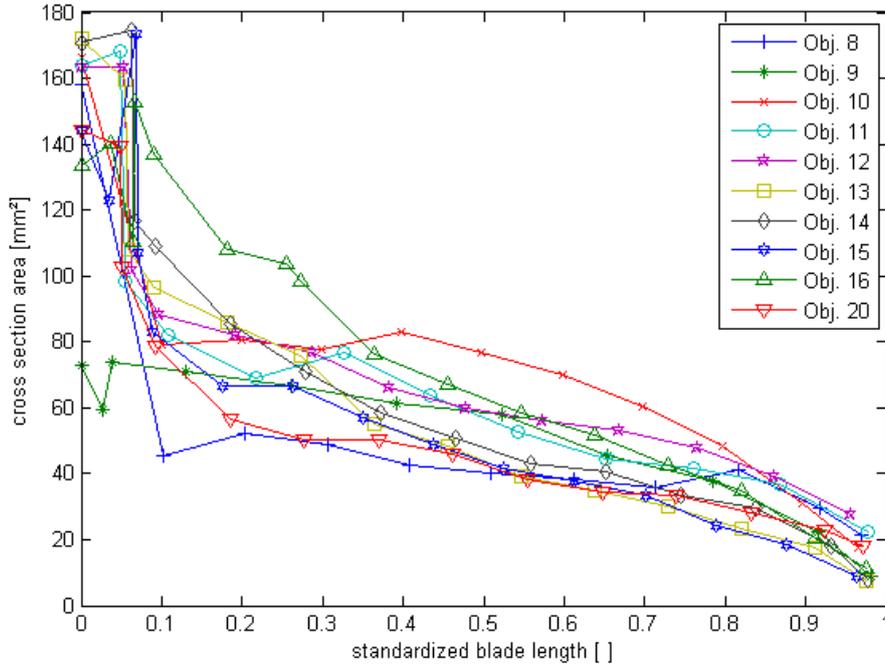
Figure 135: Cross section graph comparison of 10 one–handed swords
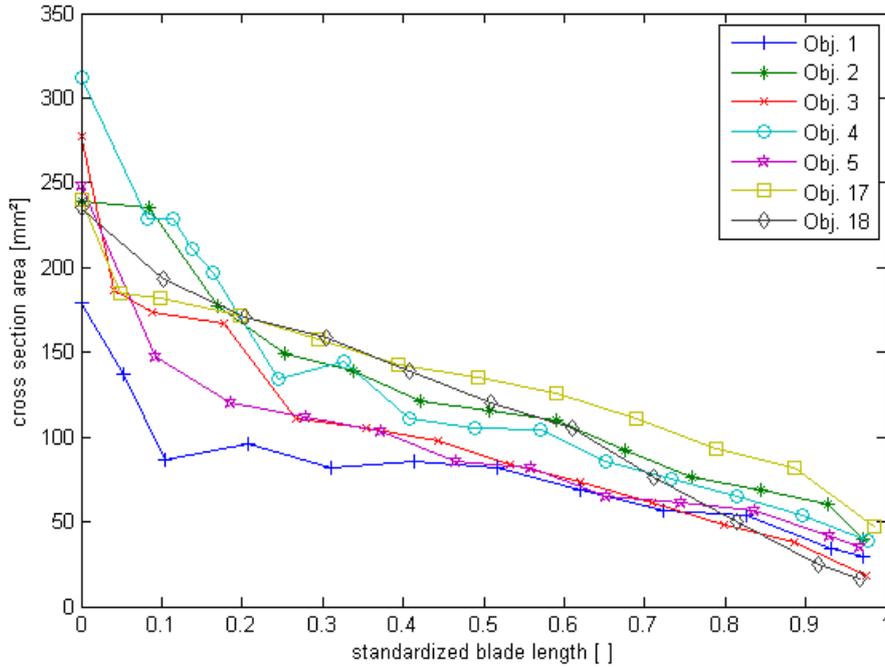
Figure 136: Cross section graph comparison of seven two–handed swords

VI.   Acknowledgements

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VII.   Copyright Statement

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