Detailed Measurement of Edged Weapons from the Wiener Heeresgeschichtliches Museum

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Abstract

In this article, 10 one–handed swords from the Heeresgeschichtliches Museum in Vienna are described in image and text and presented together with their measurements. The weapons cover a wide range of time, from the 16th to the 18th century. An authentic reconstruction of the blades is made possible based on these measurements. Furthermore, different measured and calculated parameters give insights into weapon handling.

I. Introduction

Detailed measurements of period weapons of an epoch are the most important source of information for the manufacture of authentic reproductions. Different parameters of blade geometry and mass distribution are also very illuminative for the interpretation of period fencing treatises.

In this article, 10 swords of different types, from a wide range of time (16th –18th century) are presented and compared, regarding hilt–types and blade geometry.

II. Terminology

Most of these parameters are common to all swords and quite clear, although some need a more detailed explanation, which follows. We begin with directly measurable properties.

- *Ricasso Length* – Ricasso length is measured from the crossguard to the beginning of the blade.
- *Blade Length* – Blade length is measured from the end of the ricasso to the point for one–handed weapons and from the crossguard to the point for two–handed weapons.
- *Point of Balance (POB)* – The point of balance is usually considered the main parameter of handling and it can also be easily located by balancing the sword on a finger. However, it only determines a small part of the handling characteristics. For further information, see [Le Chevalier, 2011]. It is measured from the center of the crossguard.
- *Pivot Point 1* – The distance of the pivot point from the crossguard, when the sword is being held at the ricasso block and moved laterally.

- *Pivot Point 2* – The distance of the pivot point from the crossguard, when the sword is being held at the rear end of the grip and moved laterally.
- *Crossguard Diameter* – The diameter of the crossguard at its thinnest point. This value is an indicator for the stability of the hilt.

A detailed explanation and a method for determination of pivot points and parameters like dynamic length and blade presence can be found in [Le Chevalier, 2011].

From the measurements listed above, following "virtual measuremens" can be obtained, which provide information about handling characteristics of bladed weapons.

- *Virtual Blade Weight* – This is the weight measured horizontally at pivot point 1 on the blade. It is a virtual indicator of perceived blade weight, not to be confused with actual blade weight.
- *Virtual Crossguard Weight* – This can be calculated as: overall weight minus blade weight.
- *Blade Presence* – This is a calculated parameter, representing the ratio of blade weight to overall weight.

III. Blade Cross Section Calculation

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

III.1. Hexagonal Cross Section

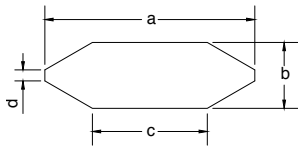

Figure 1: Hexagonal cross section

$$A = (b-d)c + ad + \frac{(b-d)(a-c)}{2} \tag{1}$$

III.2. Diamond Cross Section

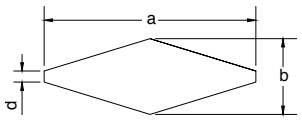

Figure 2: Diamond cross section

$$A = ad + \frac{(b-d)a}{2} \tag{2}$$

III.3. Lenticular Cross Section

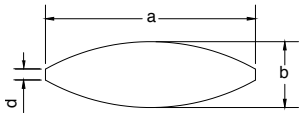

Figure 3: Lenticular cross section

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

$$A = ad + \frac{\frac{1}{2}arctan(\frac{(b-d)}{a})((b-d)^2 + a^2) + \frac{(b-d)}{2}a((b-d)^2 - a^2)}{2(b-d)^2} \tag{3}$$

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

III.4. Fuller Cross Section

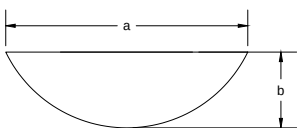

Figure 4: Fuller cross section

$$A = \frac{\frac{1}{2}arctan(\frac{2b}{a})(4b^2 + a^2)^2 + ab(4b^2 - a^2)}{16b^2} \tag{4}$$

IV. Description and Measurement of 10 Bladed Weapons

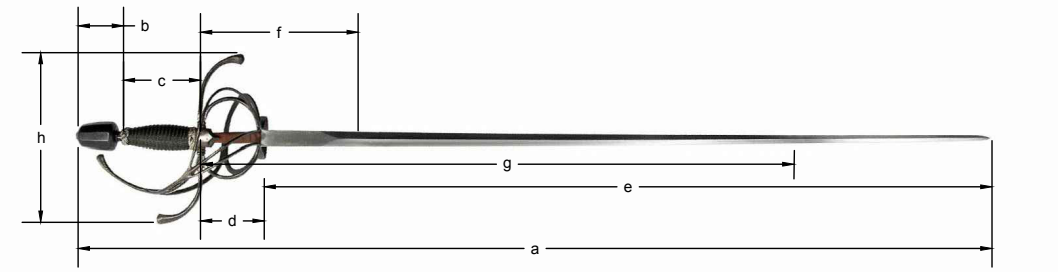

Figure 5: Sketch of one-handed sword dimensions.

IV.1. Object 1949/30/NI35630

Object number 1949/30/NI35630 is an austrian one-handed sword from the 16th century. The lenticular shaped blade is wide and thin. The hilt consists of a curved crossguard, a knuckle guard and a side ring to protect the hand. A peculiarly disc–shaped pommel with two cutouts holds the convex, wire wrapped handle in place. These swords for military use have been manufactured in large quantities and are therefore not expensively decorated or finished to a high degree. This sword is quite point heavy, yet even less strong persons can perform quick and effective cuts. Even though it has a very thin blade, it does not wobble and stays solidly in the cut–plane.

Classification according to [Norman, 1980]:

- *Hilt*: Type 14
- *Pommel*: Type 46

Figure 6: Object 1949/30/NI35630 – Hilt and forte

Figure 7: Object 1949/30/NI35630 – Hilt and forte

Figure 8: Object 1949/30/NI35630 – Point

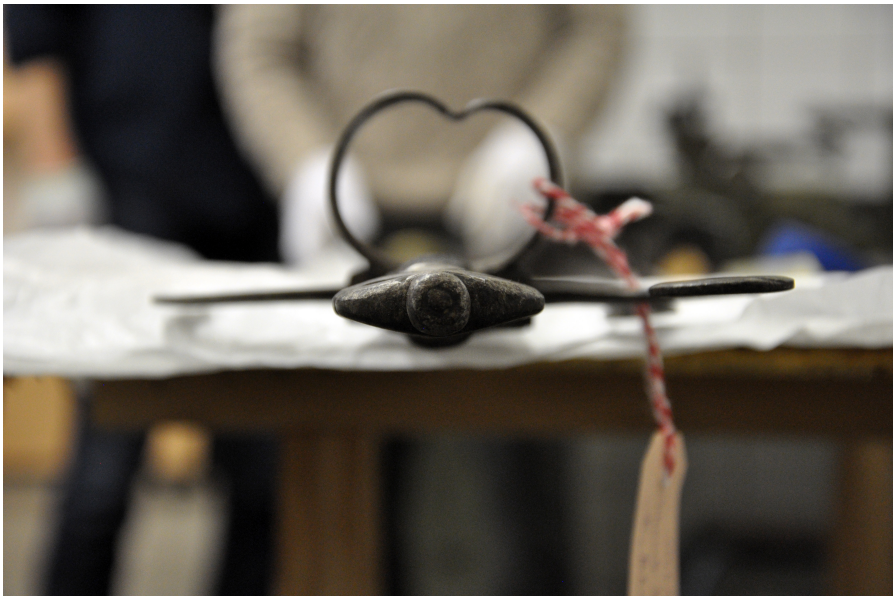

Figure 9: Object 1949/30/NI35630 – Pommel

		1949/30/NI35630 - Austrian military sword 16th c.			
Overall Length [mm]	a	984			
Overall Weight [g]		920			
Pommel Length [mm]	b	58			
Grip Length [mm]	c	86			
Quillon Block Height [mm]		11			
Quillon Block Width [mm]	d	52			
Quillon Block Thickness [mm]		22			
Blade Length [mm]	e	828			
Point of Balance [mm]	f	175			
Pivot Point 1 [mm]	g	325			
Virtual Blade Weight [g]		335			
Pivot Point 2 [mm]		520			
Virtual Crossguard Weight [g]		624			
Blade Presence [%]		36.4			
Number of Fullers		0			
Fuller Length [mm]		-			
Fuller Width [mm]		-			
Fuller Depth [mm]		-			
Distance Grip-Pommel [mm]		7			
Quillon Length [mm]	h	150			
Quillon Thickness [mm]		10x4.5			
Blade Cross Section		Lenticular			
Quillon Cross Section		Rectangle, flattened			
Grip Shape		Convex, helically coiled			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	23	27.5	18.5
		Thickness [mm]	18	24	16

Table 1: Overview of measured parameters of Object HGM - 1949/30/NI35630

l [mm]	b [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	40.5	4.7	127.2	26.5	Lenticular
100	39.2	3.7	96.9	21.6	Lenticular
200	37.3	3.4	84.7	20.8	Lenticular
300	36.6	3.2	78.2	20.0	Lenticular
400	36.1	3.3	79.6	20.9	Lenticular
500	35.4	3.3	78.0	21.3	Lenticular
600	34.4	2.7	62.0	18.0	Lenticular
700	32.9	1.7	37.3	11.8	Lenticular
800	30.6	1.2	24.5	9.0	Lenticular

Table 2: Blade Parameters of Object HGM - 1949/30/NI35630; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.2. Object 1949/30/NI35765

Object number 19149/30/NI35765 is similar to the previously described one–handed military sword, but has a different bladesmiths mark and is 120 g lighter. This sword exhibits a slightly different cross section progression with a thicker forte and stronger distal taper, which results in a less point–heavy feel and even better handling.

Classification according to [Norman, 1980]:

- *Hilt*: Type 14
- *Pommel*: Type 46

Figure 10: Object 1949/30/NI35765 – Hilt and forte

Figure 11: Object 1949/30/NI35765 – Hilt and forte

Figure 12: Object 1949/30/NI35765 – Point

Figure 13: Object 1949/30/NI35765 – Pommel

		1949/30/NI35765 - Austrian military sword, 16th c.			
Overall Length [mm]	a	951			
Overall Weight [g]		800			
Pommel Length [mm]	b	615			
Grip Length [mm]	c	803			
Quillon Block Height [mm]		10.1			
Quillon Block Width [mm]	d	47.5			
Quillon Block Thickness [mm]		15.5			
Blade Length [mm]	e	798			
Point of Balance [mm]	f	148			
Pivot Point 1 [mm]	g	294			
Virtual Blade Weight [g]		243			
Pivot Point 2 [mm]		450			
Virtual Crossguard Weight [g]		444			
Blade Presence [%]		30.4			
Number of Fullers		0			
Fuller Length [mm]		-			
Fuller Width [mm]		-			
Fuller Depth [mm]		-			
Distance Grip-Pommel [mm]		7.5			
Quillon Length [mm]	h	130			
Quillon Thickness [mm]		9x3.8			
Blade Cross Section		Lenticular			
Quillon Cross Section		Rectangle, flattened			
Grip Shape		cone-shaped			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	27.5	27.0	21.0
		Thickness [mm]	21.0	22.0	17.5

Table 3: Overview of measured parameters of Object HGM - 1949/30/NI35765

l [mm]	b [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	39.2	5.2	136.4	30.2	Lenticular
100	37.6	3.7	92.9	22.5	Lenticular
200	36.6	3.6	88.0	22.5	Lenticular
300	36.2	3.1	74.9	19.6	Lenticular
400	35.0	2.5	58.4	16.3	Lenticular
500	34.6	2.3	53.1	15.2	Lenticular
600	33.6	2.2	49.3	15.0	Lenticular
700	33.0	1.6	35.2	11.1	Lenticular
780	32.4	1.3	28.1	9.2	Lenticular

Table 4: Blade Parameters of Object HGM - 1949/30/NI35765; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.3. Object 1963/30/W1025

Object number 1963/30/W1025 is a Schiavona sidesword with an overly long blade for this sword type. The blade is symmetrical with lenticular cross section and three fullers. The hilt covers the whole hand and also has thumb ring that enables easy gripping for cuts. The handle has an elliptical cross section, a convex shape along its length and is covered with leather. A typical cats–head pommel made of brass completes the sword. Handling of this weapon is excellent, suitable both for thrusts and cuts, the balance allows quick changes of direction.

Classification according to [Norman, 1980]:

- *Hilt*: No match
- *Pommel*: No match

Figure 14: Object 1963/30/W1025 – Hilt and forte

Figure 15: Object 1963/30/W1025 – Hilt detail

Figure 16: Object 1963/30/W1025 – Point

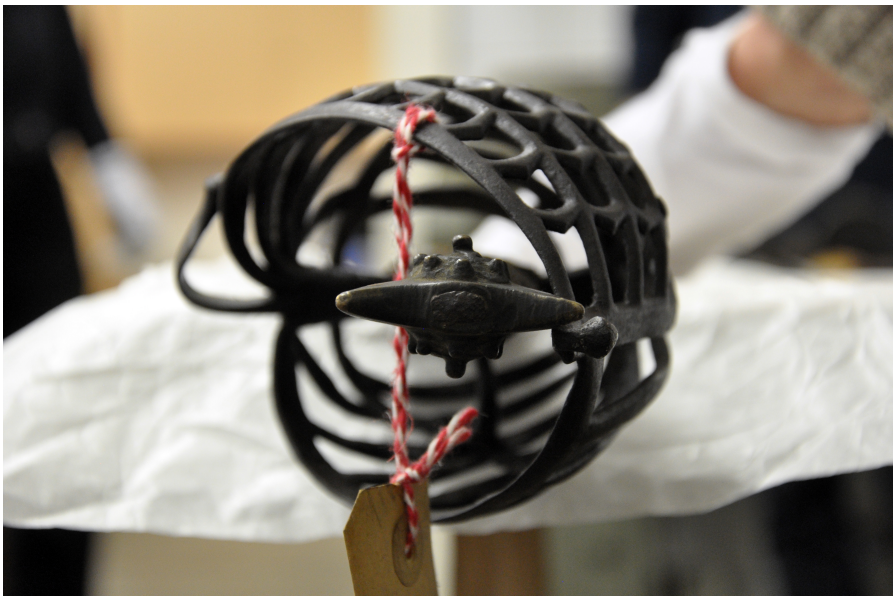

Figure 17: Object 1963/30/W1025 – Pommel

Figure 18: Object 1963/30/W1025 – Pommel

		1963/30/W1025 - Schiavona 16th/17th c.			
Overall Length [mm]	a	1135			
Overall Weight [g]		1270			
Pommel Length [mm]	b	36			
Grip Length [mm]	c	100.5			
Quillon Block Height [mm]		10			
Quillon Block Width [mm]	d	-			
Quillon Block Thickness [mm]		-			
Blade Length [mm]	e	987			
Point of Balance [mm]	f	120			
Pivot Point 1 [mm]	g	370			
Virtual Blade Weight [g]		247			
Pivot Point 2 [mm]		640			
Virtual Crossguard Weight [g]		644			
Blade Presence [%]		19.4			
Number of Fullers		3			
Fuller Length [mm]		Middle fuller to 917, outer fuller to 877			
Fuller Width [mm]		Table 6			
Fuller Depth [mm]		Table 6			
Distance Grip-Pommel [mm]		-			
Quillon Length [mm]	h	125			
Quillon Thickness [mm]		2.7 to 3.8			
Blade Cross Section		Lenticular			
Quillon Cross Section		Flat			
Grip Shape		Oval, leather-covered			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	32.0	35.0	19.0
		Thickness [mm]	19.5	24.0	16.5

Table 5: Overview of measured parameters of Object HGM - 1963/30/W1025

l [mm]	b [mm]	d [mm]	b_{fm} [mm]	b_{fo} [mm]	t_{fm} [mm]	t_{fo} [mm]	A [mm^2]	α [°]	Blade Cross Section
50	30.0	4.8	7.5	3.0	1.00	0.75	80.1	36.4	Lenticular
100	29.4	4.5	7.5	3.0	1.00	0.75	72.2	34.8	Lenticular
200	28.1	4.2	7.5	3.0	1.00	0.75	62.6	34.0	Lenticular
300	26.8	4.1	7.5	3.0	1.00	0.75	57.2	34.8	Lenticular
400	26.1	4.3	7.5	2.0	1.00	0.75	60.7	37.4	Lenticular
500	25.1	3.5	7.5	2.0	1.00	0.50	45.9	31.8	Lenticular
600	24.1	3.3	7.5	2.0	0.75	0.25	44.3	31.2	Lenticular
700	22.5	3.2	6.0	1.7	0.75	0.25	41.0	32.4	Lenticular
800	20.8	2.7	4.5	1.5	0.5	0.25	33.3	29.6	Lenticular
900	17.8	1.9	0	0	0	0	22.6	24.4	Lenticular
960	13.4	1.6	0	0	0	0	14.3	27.2	Lenticular

Table 6: Blade Parameters of Object HGM - 1963/30/W1025; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, b_{fm} ... Width of middle Fuller, b_{fo} ... Width of outer Fuller , t_{fm} ... Depth of middle Fuller, t_{fo} ... Depth of outer Fuller, A ... Cross Section Area, α ... Cutting Angle

IV.4. Object 1963/30/W1023

Object 1963/30/W1023 is, like the one described above, a Schiavona type sidesword. Yet this weapon has a triangular shape with a single edge in the first two thirds of the blade length, only the last third of the blade is sharpened on both sides. With this blade geometry the sword is sturdier in cuts.

Classification according to [Norman, 1980]:

- *Hilt*: No match
- *Pommel*: No match

Figure 19: Object 1963/30/W1023 – Hilt and forte

Figure 20: Object 1963/30/W1023 – Hilt and handle

Figure 21: Object 1963/30/W1023 – Point

Figure 22: Object 1963/30/W1023 – Pommel

		1963/30/W1023 - Schiavona 16th/17th c.		
Overall Length [mm]	a	1180		
Overall Weight [g]		1270		
Pommel Length [mm]	b	55.5		
Grip Length [mm]	c	103.5		
Quillon Block Height [mm]		10		
Quillon Block Width [mm]	d	-		
Quillon Block Thickness [mm]		-		
Blade Length [mm]	e	1007		
Point of Balance [mm]	f	120		
Pivot Point 1 [mm]	g	455		
Virtual Blade Weight [g]		290		
Pivot Point 2 [mm]		650		
Virtual Crossguard Weight [g]		623		
Blade Presence [%]		22.8		
Number of Fullers		3		
Fuller Length [mm]		upper two to 640, lower to 937		
Fuller Width [mm]		2.5		
Fuller Depth [mm]		ca. 0.15		
Distance Grip-Pommel [mm]		14		
Quillon Length [mm]	h	125		
Quillon Thickness [mm]		3 bis 3.5		
Blade Cross Section		Triangle to 640, then Lenticular		
Quillon Cross Section		Flach, flattened		
Grip Shape		Oval, convex, wrapped with wire and turks head knots		
Grip Dimensions		Distance [mm]	Start	End
		Width [mm]	34.5	23.0
		Thickness [mm]	22.0	19.0

Table 7: Overview of measured parameters of Object HGM - 1963/30/W1023

l [mm]	b [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
50	28.4	5.0	69.5	10.0	Triangle
100	27.6	5.0	67.5	10.4	Triangle
200	26.4	5.0	64.5	10.8	Triangle
300	25.5	4.4	54.6	9.9	Triangle
400	24.1	3.9	45.5	9.3	Triangle
500	23.5	3.8	43.1	9.2	Triangle
600	22.8	3.4	37.3	8.5	Triangle
700	20.2	2.9	38.7	32.7	Lenticular
800	19.3	2.8	35.7	33.0	Lenticular
900	17.1	2.1	23.5	28.0	Lenticular
1000	7.2	1.1	5.3	34.7	Lenticular

Table 8: Blade Parameters of Object HGM - 1963/30/W1023; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.5. Object 1951/30/NI39960

The edged weapon with object number 1951/30/NI39960 is a one–handed cutting sword with a broad, single–edged blade with three fullers. Its delicate hilt has protection plates on both sides to cover the thumb and index finger. The wooden handle is very thin and does not feel right when gripped. We suppose the handle was wrapped with wire or leather originally, which would have increased the circumference. The possibility that the owner of the weapon might have had small hands can be dismissed because of the handle length. This sword is point heavy and therefore mostly suitable for strong cuts.

Classification according to [Norman, 1980]:

- *Hilt*: No match
- *Pommel*: Type 60

Figure 23: Object 1951/30/NI39960 – Hilt and forte

Figure 24: Object 1951/30/NI39960 – Hilt and forte

Figure 25: Object 1951/30/NI39960 – Point

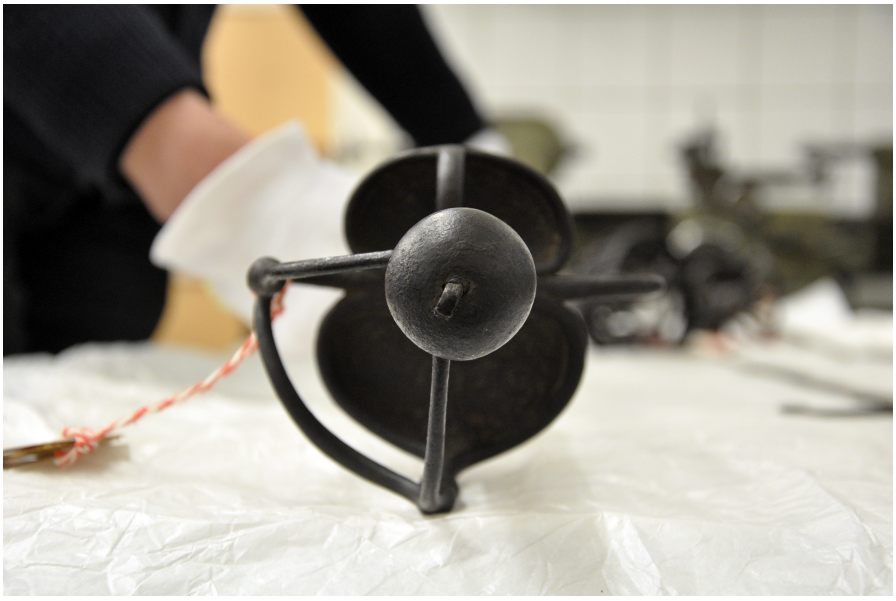

Figure 26: Object 1951/30/NI39960 – Pommel

		1951/30/NI39960 - Austrian cutting sword 17th c.		
Overall Length [mm]	a	1050		
Overall Weight [g]		1044		
Pommel Length [mm]	b	36		
Grip Length [mm]	c	99		
Quillon Block Height [mm]		9		
Blade Length [mm]	e	903		
Point of Balance [mm]	f	150		
Pivot Point 1 [mm]	g	405		
Virtual Blade Weight [g]		335		
Pivot Point 2 [mm]		720		
Virtual Crossguard Weight [g]		916		
Blade Presence [%]		32.0		
Number of Fullers		3		
Fuller Length [mm]		upper to 680, lower to 810		
Fuller Width [mm]		from 3.5 to 4.2		
Fuller Depth [mm]		0.5		
Distance Grip-Pommel [mm]		7		
Quillon Length [mm]	h	130		
Quillon Thickness [mm]		7.5x7.5		
Blade Cross Section		Triangle to 680, then Lenticular		
Quillon Cross Section		round		
Grip Shape		Oval, wood with turk head knots, to 38mm constant, then cone-shaped		
Grip Dimensions		Distance [mm]	Start	End
		Width [mm]	29.0	20.0
		Thickness [mm]	17.5	17.5

Table 9: Overview of measured parameters of Object HGM - 1951/30/NI39960

l [mm]	b [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	40.5	6.0	114.0	8.5	Triangle
100	38.4	4.7	82.7	7.0	Triangle
200	37.3	4.5	76.4	6.9	Triangle
300	35.4	3.9	61.5	6.3	Triangle
400	34.9	3.7	57.1	6.1	Triangle
500	33.6	3.3	47.9	5.6	Triangle
600	32.7	2.3	30.1	4.0	Triangle
700	31.7	1.7	30.9	12.3	Lenticular
800	31.1	1.4	24.0	10.3	Lenticular
860	30.3	1.2	24.2	9.1	Lenticular

Table 10: Blade Parameters of Object HGM - 1951/30/NI39960; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.6. Object 2013/30/171

Object Nr. 2013/30/171 is similar to the one above, but has an even broader double–edged blade. The handle of this specimen is wrapped with wire and therefore fits a hand better.

Classification according to [Norman, 1980]:

- *Hilt*: No match
- *Pommel*: Type 14

Figure 27: Object 2013/30/171 – Hilt and forte

Figure 28: Object 2013/30/171 – Hilt and forte

Figure 29: Object 2013/30/171 – Point

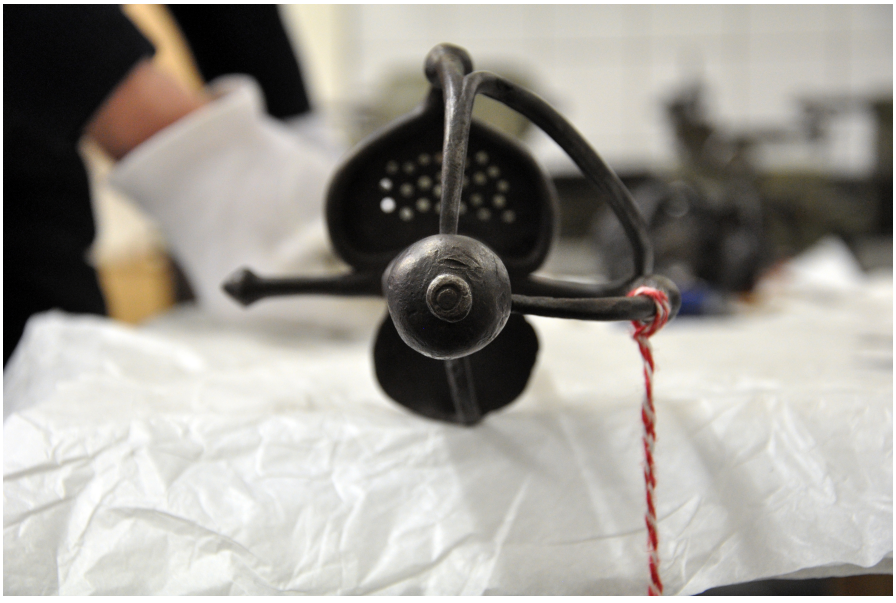

Figure 30: Object 2013/30/171 – Pommel

		2013/30/171 - Austrian cutting sword		
Overall Length [mm]	a	930		
Overall Weight [g]		1145		
Pommel Length [mm]	b	40		
Grip Length [mm]	c	94		
Quillon Block Height [mm]		7.5		
Blade Length [mm]	e	78.5		
Point of Balance [mm]	f	144		
Pivot Point 1 [mm]	g	347		
Virtual Blade Weight [g]		403		
Pivot Point 2 [mm]		510		
Virtual Crossguard Weight [g]		740		
Blade Presence [%]		35.2		
Number of Fullers		1		
Fuller Length [mm]		240		
Fuller Width [mm]		Table 12		
Fuller Depth [mm]		Table 12		
Distance Grip-Pommel [mm]		7		
Quillon Length [mm]	h	130		
Quillon Thickness [mm]		7		
Blade Cross Section		Lenticular		
Quillon Cross Section		round		
Grip Shape		Oval, convex, roughly wrapped with wire		
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	32.0	34.0	24.0
		Thickness [mm]	23.0	24.0	22.0

Table 11: Overview of measured parameters of Object HGM - 2013/30/171

l [mm]	b [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	45.0	6.0	163.2	30.4	Lenticular
100	41.5	4.8	115.7	26.4	Lenticular
200	39.8	4.9	118.8	28.1	Lenticular
300	36.6	3.8	92.9	23.7	Lenticular
400	35.0	3.5	81.8	22.8	Lenticular
500	33.0	3.5	77.2	24.2	Lenticular
600	32.1	3.3	70.8	23.5	Lenticular
700	28.7	3.1	59.5	24.7	Lenticular
750	26.2	2.6	45.5	22.7	Lenticular

Table 12: Blade Parameters of Object HGM - 2013/30/171; l ... Blade Length, b ... Blade Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.7. Object 1924/30/NI9617

Object Nr. 1924/30/NI9617 is a sword with a typical rapier blade, yet mounted into a very crudely made non–matching hilt. Due to the pommel shape, this sword can only be held with a hammer grip and the balance is not very suitable for cuts.

Classification according to [Norman, 1980]:

- *Hilt*: Type 12
- *Inner guard*: No match
- *Pommel*: Type 83

Figure 31: Object 1924/30/NI9617 – Hilt and forte

Figure 32: Object 1924/30/NI9617 – Hilt and forte

Figure 33: Object 1924/30/NI9617 – Point

Figure 34: Object 1924/30/NI9617 – Pommel

		1924/30/Ni9617 - One–handed sword 1st half of 16th c., italian style
Overall Length [mm]	a	1075
Overall Weight [g]		1260
Pommel Length [mm]	b	30
Grip Length [mm]	c	87
Ricasso [mm]		11
Blade Length [mm]	e	943
Point of Balance [mm]	f	116
Pivot Point 1 [mm]	g	460
Virtual Blade Weight [g]		324
Pivot Point 2 [mm]		705
Virtual Crossguard Weight [g]		814
Blade Presence [%]		25.7
Ricasso Width [mm]		tapered
Ricasso Thickness [mm]		23.5
Number of Fullers		1
Fuller Length [mm]		170
Fuller Width [mm]		Table 14
Fuller Depth [mm]		Table 14
Distance Grip-Pommel [mm]		6
Quillon Length [mm]	h	150 (from the middle of the hilt to end of the quillon)
Quillon Thickness [mm]		11.5 x 4.2
Blade Cross Section		Hexagon to 170, then diamond
Quillon Cross Section		Flach, flattened
Grip Shape		Oval
Grip Dimensions		Distance [mm] Start End Width [mm] 26.5 26.5 Thickness [mm] 17.0 20.0

Table 13: Overview of measured parameters of Object HGM - 1924/30/Ni9617

l [mm]	b [mm]	b_R [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	25.6	6.0	7.4	112.8	41.4	Hexagon
100	23.2	4.0	7.6	102.0	43.2	Hexagon
200	21.6	0	8.6	92.9	43.4	Diamond
300	20.0	0	8.1	81.0	44.1	Diamond
400	18.7	0	7.2	67.3	42.1	Diamond
500	17.6	0	6.9	60.7	42.8	Diamond
600	15.9	0	5.8	46.1	40.0	Diamond
700	14.6	0	5.8	42.3	43.3	Diamond
800	12.5	0	5.1	31.9	44.4	Diamond
900	9.0	0	3.4	15.3	41.4	Diamond

Table 14: Blade Parameters of Object HGM - 1924/30/Ni9617; l ... Blade Length, b ... Blade Width, b_R ... Spine Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.8. Object 1951/30/NI40318

This elegant smallsword with object number 1951/30/NI40318 features a precisely worked and richly decorated triangular and hollow–ground blade. The whole hilt is decorated with filework and gemmed with glass stones, therefore the handle cannot be gripped smoothly. However, handling, balance and point control are first–class.

Classification according to [Norman, 1980]:

- *Hilt*: Type 112
- *Inner guard*: symmetrical
- *Pommel*: similar to Type 89

Figure 35: Object 1951/30/NI40318 – Hilt and forte

Figure 36: Object 1951/30/NI40318 – Hilt and forte

Figure 37: Object 1951/30/NI40318 – Point

Figure 38: Object 1951/30/NI40318 – Pommel

		1951/30/Ni40318 - Smallsword 18th c.			
Overall Length [mm]	a	986			
Overall Weight [g]		395			
Pommel Length [mm]	b	52.5			
Grip Length [mm]	c	96.5			
Ricasso [mm]		31			
Blade Length [mm]	e	800			
Point of Balance [mm]	f	50			
Pivot Point 1 [mm]	g	200			
Virtual Blade Weight [g]		54			
Pivot Point 2 [mm]		675			
Virtual Crossguard Weight [g]		287			
Blade Presence [%]		13.7			
RicassoWidth [mm]		-			
RicassoThickness [mm]		12.5			
Number of Fullers		0			
Fuller Length [mm]		-			
Fuller Width [mm]		-			
Fuller Depth [mm]		-			
Distance Grip-Pommel [mm]		-			
Quillon Length [mm]	h	9.5			
Quillon Thickness [mm]		3.5 x 3.5			
Blade Cross Section		Triangular, hollow ground			
Quillon Cross Section		Rectangle			
Grip Shape		Rectangle, tapered on both ends			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	11.5	26.0	10.0
		Thickness [mm]	11.5	26.0	10.0

Table 15: Overview of measured parameters of Object HGM - 1951/30/Ni40318

l [mm]	b [mm]	d [mm]	t_{HGB} [mm]	t_{HGS} [mm]	A [mm^2]	α [°]	Blade Cross Section
0	20.0	8.9	1.0	0.0	75.6	41.7	Triangle
100	16.3	7.4	2.8	1.2	11.4	42.2	Triangle
200	14.0	6.9	2.5	1.1	9.8	44.6	Triangle
300	12.2	6.4	2.2	1.1	7.6	46.4	Triangle
400	10.9	6.0	1.9	1.0	7.6	47.8	Triangle
500	9.9	5.7	1.6	0.8	9.3	49.0	Triangle
600	8.8	4.7	1.4	0.7	6.2	46.9	Triangle
700	7.7	4.2	1.2	0.6	5.3	47.5	Triangle
770	6.2	3.7	0.8	0.5	4.8	50.0	Triangle

Table 16: Blade Parameters of Object HGM - 1951/30/Ni40318; l ... Blade Length, b ... Blade Width, t_{HGB} [mm] ... Depth of hollow grinding on the back, t_{HGS} [mm] ... Depth of hollow grinding on the sides , d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.9. Object 1951/30/NI40201

Object nr. 1951/30/NI40201 is a smallsword with a solid, hexagonal blade that could easily parry heavier weapons. Protection plate, knuckle bar and pommel are made of brass and beautifully engraved. The convex handle is made of painted wood. This smallsword is somewhat point heavy, yet handling is excellent.

Classification according to [Norman, 1980]:

- *Hilt*: Type 112
- *Inner guard*: symmetrical
- *Pommel*: Type 89

Figure 39: Object 1951/30/NI40201 – Hilt and forte

Figure 40: Object 1951/30/NI40201 – Hilt and forte

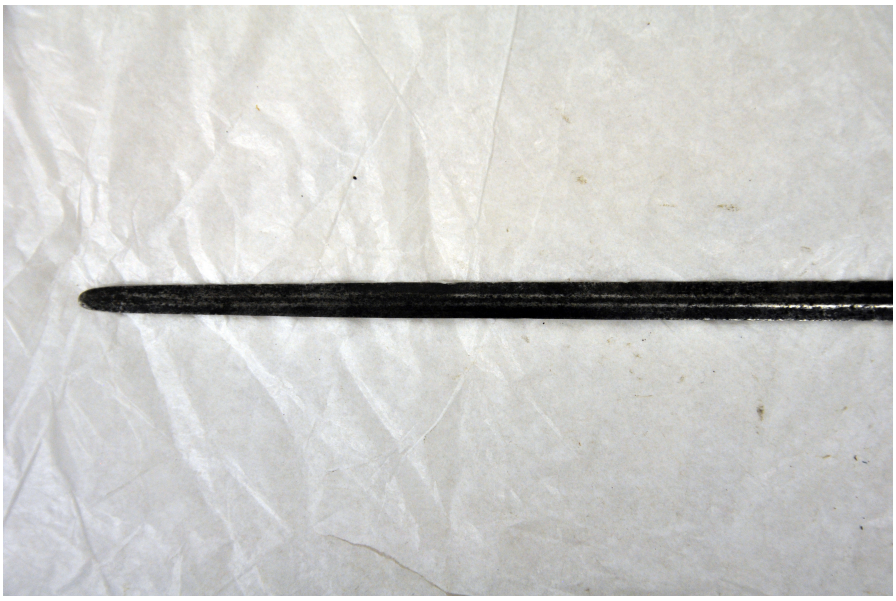

Figure 41: Object 1951/30/NI40201 – Point

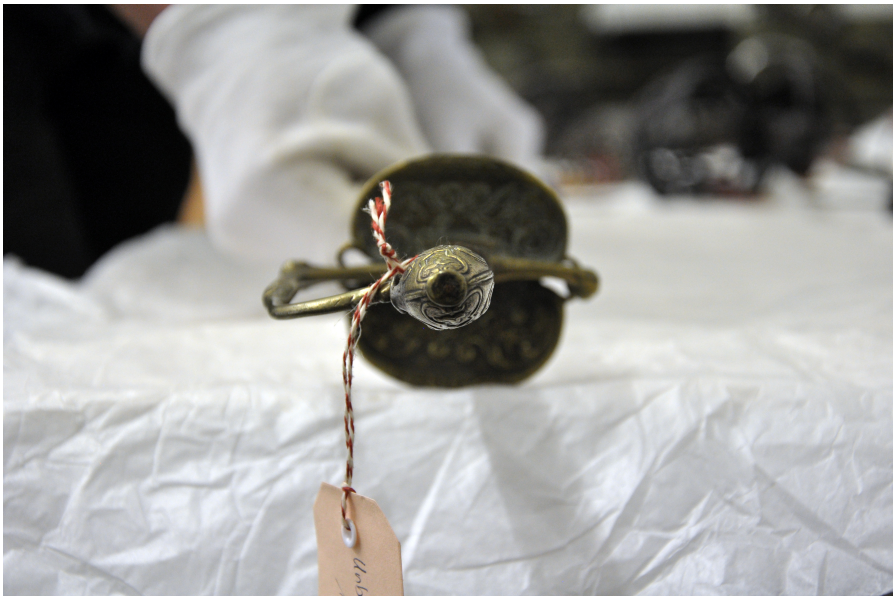

Figure 42: Object 1951/30/NI40201 – Pommel

		1951/30/Ni40201 - Smallsword 18th c.			
Overall Length [mm]	a	980			
Overall Weight [g]		434			
Pommel Length [mm]	b	46			
Grip Length [mm]	c	83			
Ricasso [mm]		31			
Blade Length [mm]	e	72.3			
Point of Balance [mm]	f	84			
Pivot Point 1 [mm]	g	295			
Virtual Blade Weight [g]		100			
Pivot Point 2 [mm]		595			
Virtual Crossguard Weight [g]		345			
Blade Presence [%]		23.0			
RicassoWidth [mm]		-			
RicassoThickness [mm]		13.0			
Number of Fullers		1			
Fuller Length [mm]		from 70 to 145			
Fuller Width [mm]		2.5			
Fuller Depth [mm]		0.5			
Distance Grip-Pommel [mm]		-			
Quillon Length [mm]	h	95			
Quillon Thickness [mm]		5.5			
Blade Cross Section		Hexagon			
Quillon Cross Section		Round			
Grip Shape		Convex			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	17.5	22.0	14.0
		Thickness [mm]	13.5	17.0	12.0

Table 17: Overview of measured parameters of Object HGM - 1951/30/Ni40201

l [mm]	b [mm]	b_R [mm]	d [mm]	A [mm^2]	α [°]	Blade Cross Section
0	18.4	6.5	6.1	75.9	54.3	Hexagon
100	15.3	4.8	4.3	41.5	44.5	Hexagon
200	13.9	3.6	3.9	34.1	41.5	Hexagon
300	13.2	3.4	4.1	34.0	45.4	Hexagon
400	12.4	3.4	3.6	28.4	43.6	Hexagon
500	11.1	3.2	3.2	22.9	44.1	Hexagon
600	10.0	3.0	2.7	17.6	42.2	Hexagon
700	7.8	3.0	1.8	9.7	41.1	Hexagon

Table 18: Blade Parameters of Object HGM - 1951/30/Ni40201; l ... Blade Length, b ... Blade Width, b_R ... Spine Width, d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

IV.10. Object 1951/30/NI40205

Object Nr. 1951/30/NI40205 is another smallsword with a triangular, hollow–ground and decorated blade. Overall weight is just 308 g. Due to the comparatively heavy blade and the very delicate hilt, the felt weight is in the forte of the weapon which allows for quick and stable handling. The handle is covered in velvet and, even for this type of sword, very thin.

Classification according to [Norman, 1980]:

- *Hilt*: Type 112
- *Inner guard*: symmetrical
- *Pommel*: similar to Type 89

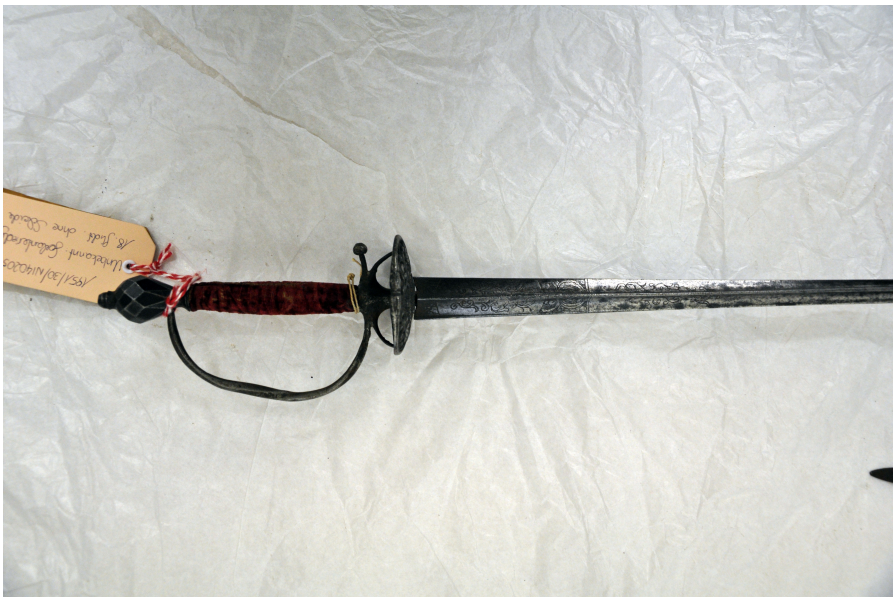

Figure 43: Object 1951/30/NI40205 – Hilt and forte

Figure 44: Object 1951/30/NI40205 – Hilt and forte

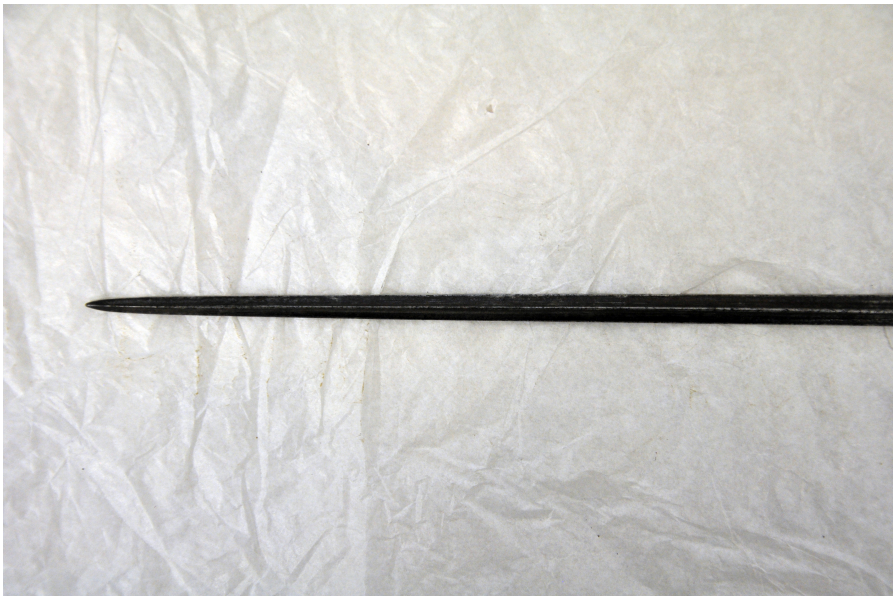

Figure 45: Object 1951/30/NI40205 – Point

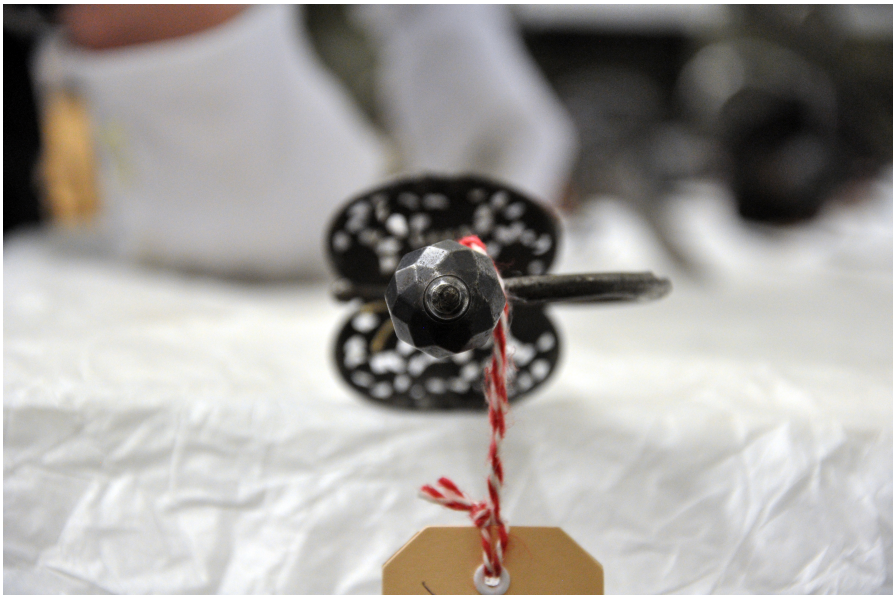

Figure 46: Object 1951/30/NI40205 – Pommel

		1951/30/Ni40205 - Smallsword 18th c.			
Overall Length [mm]	a	1010			
Overall Weight [g]		308			
Pommel Length [mm]	b	46			
Grip Length [mm]	c	81			
Ricasso [mm]		28.5			
Blade Length [mm]	e	850			
Point of Balance [mm]	f	115			
Pivot Point 1 [mm]	g	375			
Virtual Blade Weight [g]		87			
Pivot Point 2 [mm]		610			
Virtual Crossguard Weight [g]		205			
Blade Presence [%]		28.2			
RicassoWidth [mm]		-			
RicassoThickness [mm]		12.5			
Number of Fullers		-			
Fuller Length [mm]		-			
Fuller Width [mm]		-			
Fuller Depth [mm]		-			
Distance Grip-Pommel [mm]		-			
Quillon Length [mm]	h	80			
Quillon Thickness [mm]		3.0x3.0			
Blade Cross Section		Triangular hollow–ground			
Quillon Cross Section		Round			
Grip Shape		Oval, convex, covered with velvet			
Grip Dimensions		Distance [mm]	Start	Middle	End
		Width [mm]	12.0	16.0	12.0
		Thickness [mm]	13.0	14.0	11.0

Table 19: Overview of measured parameters of Object HGM - 1951/30/Ni40205

l [mm]	b [mm]	d [mm]	t_{HGB} [mm]	t_{HGS} [mm]	A [mm^2]	α [°]	Blade Cross Section
0	21.7	9.6	1.2	1.1	65.4	41.5	Triangle
100	17.2	8.8	2.3	1.7	20.6	45.7	Triangle
200	13.3	7.2	1.9	1.3	13.5	47.3	Triangle
300	11.7	7.5	1.8	1.2	14.2	52.0	Triangle
400	10.5	6.2	1.6	0.8	12.4	49.7	Triangle
500	9.7	6.1	1.4	0.7	13.1	51.5	Triangle
600	8.6	5.1	1.2	0.5	10.5	49.9	Triangle
700	7.7	4.4	1.0	0.5	7.8	48.8	Triangle
800	6.0	3.4	0.8	0.3	5.1	48.6	Triangle

Table 20: Blade Parameters of Object HGM - 1951/30/Ni40205; l ... Blade Length, b ... Blade Width, t_{HGB} [mm] ... Depth of hollow grinding on the back, t_{HGS} [mm] ... Depth of hollow grinding on the sides , d ... Blade Thickness, A ... Cross Section Area, α ... Cutting Angle

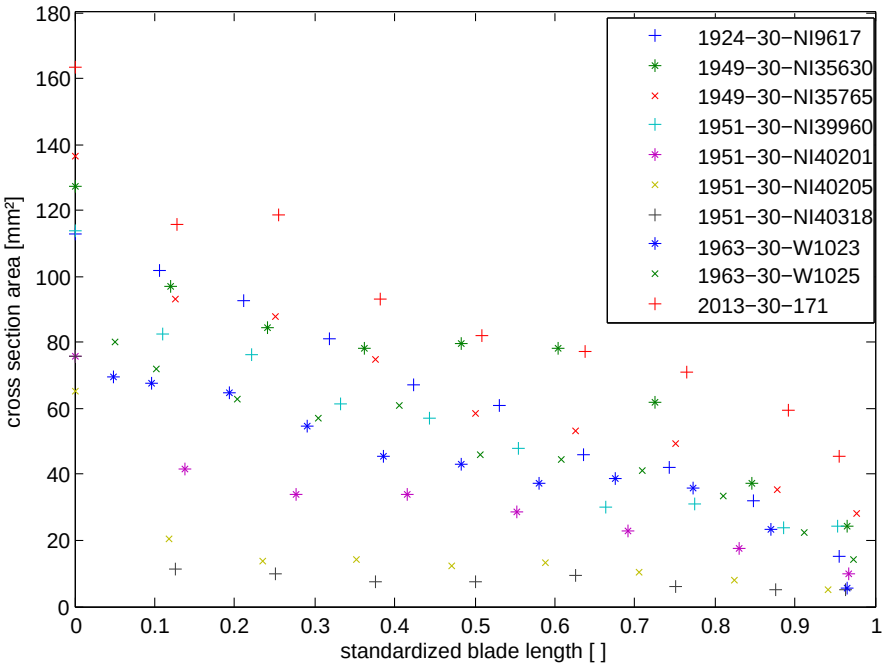

Figure 47: Cross section versus standardised blade length of all objects.

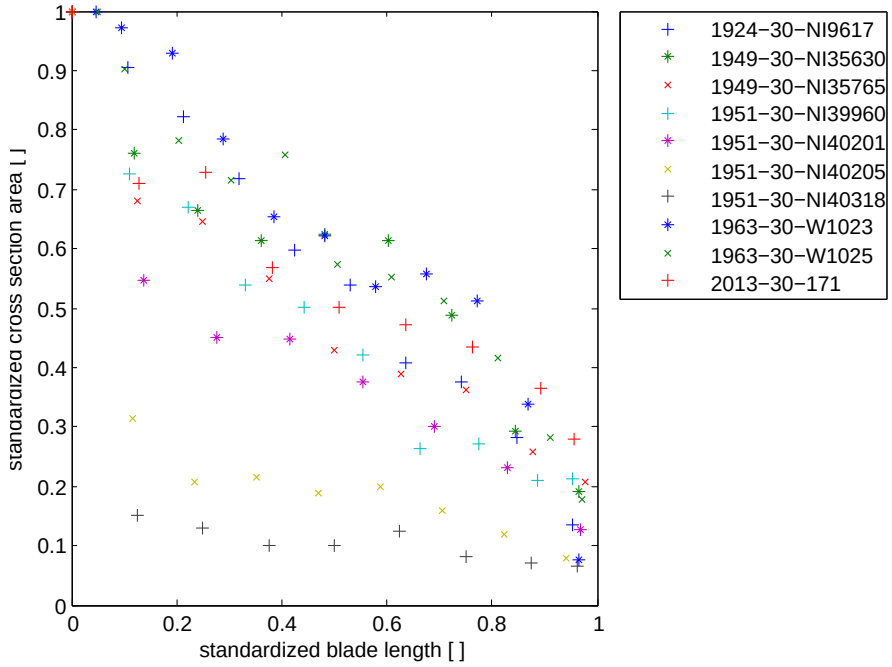

Figure 48: Standardised cross section versus standardised blade length of all objects.

References

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A.V.B. Norman. *The Rapier and Smallsword: 1460-1820*. Ayer Company Publishers, Inc., 1980.