Annexe 1 : analysis of Bronze age metalwork from Vufflens-la-Ville VD

Autor(en): **Northover, Peter**

Objekttyp: **Appendix**

Zeitschrift: **Cahiers d'archéologie romande**

Band (Jahr): **100 (2005)**

PDF erstellt am: **27.05.2024**

Nutzungsbedingungen

Die ETH-Bibliothek ist Anbieterin der digitalisierten Zeitschriften. Sie besitzt keine Urheberrechte an den Inhalten der Zeitschriften. Die Rechte liegen in der Regel bei den Herausgebern.
Die auf der Plattform e-periodica veröffentlichten Dokumente stehen für nicht-kommerzielle Zwecke in Lehre und Forschung sowie für die private Nutzung frei zur Verfügung. Einzelne Dateien oder Ausdrucke aus diesem Angebot können zusammen mit diesen Nutzungsbedingungen und den korrekten Herkunftsbezeichnungen weitergegeben werden.
Das Veröffentlichen von Bildern in Print- und Online-Publikationen ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. Die systematische Speicherung von Teilen des elektronischen Angebots auf anderen Servern bedarf ebenfalls des schriftlichen Einverständnisses der Rechteinhaber.

Haftungsausschluss

Alle Angaben erfolgen ohne Gewähr für Vollständigkeit oder Richtigkeit. Es wird keine Haftung übernommen für Schäden durch die Verwendung von Informationen aus diesem Online-Angebot oder durch das Fehlen von Informationen. Dies gilt auch für Inhalte Dritter, die über dieses Angebot zugänglich sind.

Ein Dienst der *ETH-Bibliothek*
ETH Zürich, Rämistrasse 101, 8092 Zürich, Schweiz, www.library.ethz.ch

http://www.e-periodica.ch

ANNEXE 1

Analysis of Bronze age metalwork from Vufflens-la-Ville VD

Par Peter Northover[1]

Six samples from Bronze Age metal artifacts excavated at Vufflens-la-Ville VD were submitted for compositional analysis. The objects, their dating, and sample numbers are listed below:

VF95/ST9-86	.Roll-headed pin	. . . .Bz B/C	. . .Sample Vuff 1
VF94/ST1-1	. .Lozengic awl	. . . . . .Bz A2b/B1	Sample Vuff 2
VF96/S9-8	. . . .Roll-headed pin	. . . .Bz ?	. . . . . .Sample Vuff 3
VF95/ST10-36	Riveted knife-dagger	.Bz B/C	. . .Sample Vuff 4
VF96/S13-1	. . .Ribbed gold bracelet	.Bz B?	. . . . .Samples Vuff 5-6

Preparation and analysis

The samples, in the form of drillings, were hot-mounted in a carbon-filled thermosetting resin, ground and polished to a 1µm diamond finish. Analysis was by electron probe microanalysis with wavelength dispersive spectrometry; operating conditions were an accelerating voltage of 25 kV, a beam current of 30nA, and an X-ray take-off angle of 40°. Thirteen elements were sought, as listed in the accompanying table; pure element and mineral standards were used with a counting time of 10s per element. Detection limits were typically 100-200ppm with the exception of 400ppm for gold in bronze and for tin in the presence of silver.

Three to five areas, each 30x50µm, were analysed on each sample; the individual compositions and their means, normalised to 100%, are shown in the table. All concentrations are in weight %.

The alloys

The four copper alloy samples (Vuff 1-4) were all made from medium tin unleaded bronzes with approximately 8-10% tin. Impurity levels are generally low but varied: Vuff 1 and 4 are similar to each other but differ significantly from the other two. The two gold samples from the bracelet are virtually identical and represent an unalloyed natural gold containing 17,9% silver with a small copper impurity.

The compositions of Middle Bronze Age copper alloy metalwork in Switzerland have been extensively studied by Rychner and Kläntschi (1995) and a scheme for classifying them devised by Rychner in the same work. The alloy contents may be very briefly considered. Rychner and Kläntschi (*op. cit.*, vol. 1, p 61, vol. 2, 126, tab. 15) show that through the Middle Bronze Age and into the later Bronze Age (Bz B-Ha A2) in Switzerland tin contents were remarkably stable with a quite narrow range. The mean tin content throughout this time lay between 8% and 9% matching the compositions of this group of four objects very precisely. The same level of tin contents stretches back into Bz A for artefacts with low levels of impurities. Lead during the Middle Bronze Age is nowhere at alloy levels but does drift upwards from a mean of 0,08% in Bz B/C to 0,97% in Ha A2 (*op. cit.*, vol. 2, 126, tab. 16). The lead contents of three of the objects analysed here are at trace level only, with just one roll-headed pin (Vuff 3, VF96/S9-8) having a significant lead impurity of 0.2%. This could indicate a later date, say Bz D-Ha A1 but the variability of lead contents at each period means that this must remain just a suggestion. Actually other features of this composition serve differentiate it, as will be discussed below.

Rychner's scheme for classifying Bronze Age impurity patterns is based on ranking the three impurities arsenic (As), antimony (Sb), and nickel (Ni); each group was then subdivided on the basis of the sum of the concentrations of these impurities. This process was applied to the four bronze analyses from Vufflens; the results are shown in the following table.

Sample	Object	Pattern	Total	Group	Sub-Group
Vuff 1	. .VF95/ST9-86	. . . .As = Sb > Ni	. . .0,20%	. .1	. . . .P
Vuff 2	. .VF94/ST1-1	. . . . .Ni > Sb = As	. . .0,09%	. .4	. . . .P
Vuff 3	. .VF95/S9-8	. . . . . .Ni > Sb = As	. . .0,50%	. .3	. . . .N
Vuff 4	. .VF95/ST10-36	. . .As = Sb > Ni	. . .0,13%	. .1	. . . .P

The division between Rychner's P ('Pauvre') and N ('Normal') sub-groups is at 0,42% total impurities. Groups 3N, 4N, 5N and 6N were further sub-divided on the basis of a cluster analysis. Rychner's discussion then reviews each group in turn in terms of their chronological and geographical distributions. We straight away find that Group 1P is extremely unusual in a Middle Bronze Age context, having its maximum occurrence in Bz D - Ha A1, with the largest proportion in the west of Switzerland. The feature that defines these two analyses as group 1P is their very low nickel content and a search among the other MBA analyses shows that this is generally scarce in the MBA. While it is possible typologically to see a home in Bz D for the roll-headed pin this might not be so easy for the dagger where a look backwards to Bz A2 might be more appropriate. The lozengic awl, Vuff 2, already indicates that metalwork of that date might be found at Vufflens and its Group 4P composition is as uncommon in the Middle Bronze Age as group 1P.

Many Early Bronze Age objects have been analysed in Switzerland (Junghans *et al.* 1968, 1974) and inspection of

[1] Department of Materials, Oxford.

them shows many objects with very low nickel contents. A lot of these also have very low levels of other impurities as well, much lower than seen here, but there is a number of parallels for the Vufflens composition. Using the analysis numbers of Junghans and colleagues we may point to a bronze roll-headed pin from Yverdon with 0,07% Sb, 0,07% Ni and tr. As, a dagger from Zeneggen with 7,4% tin, 0,08% As, tr. Sb, and 0,046% Ni, and a *Scheibenkopfnadel* from Saillon with –10% Sn, 0,19% As, 0,03% Sb and 0,056% Ni. If typologically and contextually either a Bz A or Bz D date is inappropriate for any of the analysed bronzes from Vufflens, then it could be argued small and simple objects might be made in Bz B from a residue of scrap from Bz A. If the typology does allow an early date but the context does not then the objects themselves could be survivors from an earlier period.

The Group 3N composition of roll-headed pin Vuff 3 is appropriate for the Middle Bronze Age, over 50% of Rychner an Kläntschi's analyses in that sub-group coming from that period. However, the corpus includes relatively few pins, and one of the two roll-headed pins in it has a Group 3N composition but comes from an HaA2 context in Hauterive-Champréveyres. An unusual feature of Vuff 3's composition is the zinc impurity of 0,10%. Reference to Rychner and Kläntschi's Figure 9c (1995, vol. 2, p. 132) shows that zinc as an impurity is most common in the range 0,01-0,10% in the period Bz D-Ha A1, which tends to support the chronological bias of the other analyses. This is in conflict with archaeological dating in favour of a Middle Bronze Age date. The conflict might be resolved if the bias of Rychner and Kläntschi's corpus in favour of larger objects were rectified.

The compositions of ancient goldwork from Switzerland have been reviewed by Voûte (1991), including those previously published by Hartmann, while the limited repertoire of Swiss Bronze Age gold has been described by Borello. Unfortunately very little pre-Hallstatt gold in Switzerland has been analysed so that we cannot say how typical the analysis is. The analysis suggests the use of an unalloyed natural gold, with some contamination with copper since the copper content is above the natural level of most gold deposits and placers. The low tin content is certainly matched in the Chalcolithic beaker from Eschenz, and in a variety of Hallstatt period goldwork in Switzerland. Gold of the compositions seen at Vufflens was therefore potentially available in Switzerland in the Bronze Age.

Conclusions

The compositions of the four bronze objects present considerable problems in interpretation. They are best matched by objects from Bz A, or from Bz D-Ha A1, and have virtually no parallels in Bz B/C. While one roll-headed pin could be as late as Bz D, it is perhaps best to look to the other objects being residual from, or made from metal that was residual from Bz A. There are insufficient comparative analyses to draw any conclusions about gold other than to say that gold of the observed composition was used in Switzerland in the Bronze Age.

References

M.A. Borello, 1991 : Jungsteinzeit und Bronzezeit : die Entdeckung und Beherrschung der Metalle, in A. Furger and F. Müller, *Gold der Helvetier: Keltische Kostbarkeiten aus der Schweiz*, (Zürich : Schweizerisches Landesmuseum), 52-55

S. Junghans, E. Sangmeister and M. Schröder, 1968 : *Kupfer und Bronze in der frühen Metallzeit Europas : Die Materialgruppen beim Stand von 12000 Analysen*, (Berlin : Gebrüder Mann Verlag : Studien zu den Anfängen der Metallurgie, 2.1-3)

S. Junghans, E. Sangmeister and M. Schröder, 1974 : *Kupfer und Bronze in der frühen Metallzeit Europas : Katalog der Analysen 10041-22000 (mit Nachuntersuchungen der Analysen Nr. 1-10040)*, (Berlin: Gebrüder Mann Verlag: Studien zu den Anfängen der Metallurgie, 2.4)

V. Rychner and N. Kläntschi, 1995 : *Arsenic, antimoine et nickel*, (Lausanne : Cahiers d'Archéologie Romande, 63)

A. Voûte, 1991 : Die Analysenverfahren für Goldgegenstände, in A. Furger and F. Müller, *Gold der Helvetier: Keltische Kostbarkeiten aus der Schweiz*, (Zürich : Schweizerisches Landesmuseum), 49-51

ANALYSES DES OBJETS DE MÉTAL DE VUFFLENS-LA-VILLE VD EN SENCY – PETER NORTHOVER, OXFORD – MARS 2000

N° échant.	Référence	Description	Cu	Sn	Pb	As	Sb	Ag	Ni	Bi	Co	Zn	Fe	Au	S
Vuff 1.1	VF95/ST9-86	épingle à tête enroulée	90.96	8.53	0.00	0.13	0.09	0.12	0.01	0.08	0.00	0.05	0.01	0.00	0.02
Vuff 1.2			92.41	7.22	0.00	0.10	0.06	0.09	0.02	0.00	0.00	0.01	0.02	0.00	0.06
Vuff 1.3			91.84	7.85	0.00	0.07	0.05	0.13	0.00	0.00	0.00	0.00	0.02	0.00	0.02
Vuff 1.4			91.43	7.96	0.04	0.11	0.11	0.14	0.04	0.00	0.02	0.04	0.04	0.07	0.01
Vuff 2.1	VF94/ST1-1	alêne losangique	89.97	9.61	0.04	0.02	0.03	0.01	0.04	0.00	0.02	0.01	0.06	0.05	0.13
Vuff 2.2			90.14	9.58	0.00	0.00	0.00	0.01	0.08	0.00	0.00	0.05	0.07	0.00	0.08
Vuff 2.3			89.84	9.53	0.00	0.01	0.04	0.01	0.04	0.04	0.02	0.14	0.27	0.00	0.06
Vuff 3.1	VF96/S9-8	épingle à tête enroulée	88.93	9.99	0.02	0.12	0.10	0.03	0.34	0.06	0.05	0.12	0.21	0.00	0.04
Vuff 3.2			88.89	9.88	0.33	0.11	0.05	0.00	0.24	0.06	0.03	0.14	0.21	0.00	0.05
Vuff 3.3			88.98	9.98	0.24	0.10	0.12	0.00	0.30	0.00	0.04	0.04	0.19	0.01	0.01
Vuff 4.1	VF95/ST10-36	lame de poignard	91.23	8.16	0.02	0.08	0.04	0.05	0.01	0.05	0.00	0.07	0.19	0.00	0.10
Vuff 4.2			90.13	9.55	0.02	0.07	0.06	0.04	0.00	0.03	0.02	0.02	0.06	0.00	0.01
Vuff 4.3			90.68	8.95	0.00	0.03	0.05	0.08	0.05	0.00	0.00	0.00	0.12	0.00	0.05
Vuff 5.1	VF96/S13-1	fragment de bracelet	0.12	0.00	0.02	0.00	0.00	17.64	0.01	0.00	0.01	0.00	0.00	82.20	0.00
Vuff 5.2			0.12	0.00	0.07	0.00	0.03	18.08	0.00	0.00	0.03	0.00	0.01	81.65	0.00
Vuff 5.3			0.25	0.00	0.00	0.00	0.03	17.90	0.00	0.00	0.05	0.00	0.00	81.77	0.01
Vuff 5.4			0.21	0.00	0.18	0.00	0.02	17.89	0.02	0.00	0.00	0.00	0.02	81.65	0.01
Vuff 5.5			0.12	0.00	0.00	0.01	0.03	17.78	0.00	0.00	0.00	0.00	0.04	82.02	0.00
Vuff 6.1	VF96/S13-1	fragment de bracelet	0.18	0.00	0.00	0.00	0.00	17.85	0.00	0.00	0.00	0.00	0.01	81.96	0.00
Vuff 6.2			0.16	0.00	0.01	0.00	0.00	17.98	0.00	0.00	0.05	0.00	0.04	81.75	0.01
Vuff 6.3			0.16	0.00	0.07	0.00	0.00	17.81	0.00	0.00	0.01	0.00	0.00	81.94	0.00
Vuff 6.4			0.14	0.00	0.05	0.00	0.03	18.37	0.02	0.00	0.00	0.00	0.02	81.37	0.00
Vuff 1	VF95/ST9-86	épingle à tête enroulée	91.66	7.89	0.01	0.10	0.08	0.12	0.02	0.02	0.00	0.02	0.03	0.02	0.03
Vuff 2	VF94/ST1-1	alêne losangique	89.98	9.57	0.01	0.01	0.02	0.01	0.06	0.01	0.01	0.06	0.14	0.02	0.09
Vuff 3	VF96/S9-8	épingle à tête enroulée	88.93	9.95	0.20	0.11	0.09	0.01	0.30	0.04	0.04	0.10	0.20	0.00	0.03
Vuff 4	VF95/ST10-36	lame de poignard	90.68	8.89	0.01	0.06	0.05	0.06	0.02	0.02	0.01	0.03	0.12	0.00	0.05
Vuff 5	VF96/S13-1	fragment de bracelet	0.17	0.00	0.07	0.00	0.02	17.87	0.01	0.00	0.02	0.00	0.01	81.82	0.01
Vuff 6	VF96/S13-1	fragment de bracelet	0.15	0.00	0.03	0.00	0.01	17.96	0.00	0.00	0.01	0.00	0.02	81.81	0.00