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ET D'HISTOIRE ANCIENNE

NOUVELLE SÉRIE

LXV

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INSTITUT D'ARCHÉOLOGIE « VASILE PÂRVAN »

D A C I A

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ET D'HISTOIRE ANCIENNE

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X-RAY FLUORESCENCE ANALYSIS ON THE SILVER ITEMS FROM RUCĂR – *PLEAȘA POSADEI*

DRAGOȘ ALEXANDRU MIREA*

Keywords: X-Ray Fluorescence, silver bracelets, Roman Age

Abstract: Two Roman Age silver bracelets and a *denarius* were uncovered at Rucăr. These finds were analysed using X-Ray Fluorescence (XRF) in order to obtain additional information regarding the composing alloy.

Cuvinte-cheie: Fluorescență de Raze X, brățări de argint, epoca romană

Rezumat: Două brățări de argint, datate în epoca romană, și un *denarius* au fost descoperite la Rucăr. Aceste descoperiri au fost analizate utilizând Fluorescența de Raze X (XRF), pentru a obține informații adiționale în legătură cu aliajul din care au fost fabricate.

The analysis of the two bracelets and coin¹ was performed using the X-Ray Fluorescence (XRF) technique, by the use of a portable Bruker Tracer S1 Titan apparatus. The spectrometer uses a rhodium (Rh) anode in order to generate an incident X-ray beam characterized by a resolution, for the medium energies domain to which the transitional metals belong to (from scandium to zirconium), of approximately 120 eV, according to the manufacturer. This resolution is given by the Silicon Drift Detector (SDD), which is positioned backwards of the anode tube, at an angle of approximately 45° with respect to the emitted beam, to record the characteristic response emitted by the item, minimising the anode's effects. The X-ray beam's energy is limited by the apparatus at a value of 50 keV, for safety reasons. This was also the energy used in order to perform the analysis. The emitted X-ray beam first passes through a collimator before reaching the analysed item. The collimator's effect consists in modulating the beam into a circular form which, according to the manufacturer, has a spot of 8 mm in diameter on the item. Each item was analysed on its significant areas, in order to determine whether the items were manufactured using the same raw materials. Before the analysis was performed, the areas chosen were carefully cleaned using ethanol. The recorded spectra were analysed using the Bruker Instrument Tools software, provided by the apparatus manufacturer. This software is used in order to obtain relevant data regarding the chemical composition of the analysed items. Considering the fact that the geometry inside the apparatus cannot be modified by the end user, the manufacturer was able to design specific applications aimed at precise elemental composition determination. Such an application, destined to identify various types of commercial and unknown types of alloys was used to record the presented data. This application was designed by the manufacturer using a large range of standards. It is also important to mention the fact that the accuracy of this application and the apparatus is being checked periodically, by the reseller². These data obtained are presented in Table 1, expressed in wt% percentages, followed by the uncertainties.

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¹ For the discovery context see the article of Dragoș Măndescu and Daniel Spănu in this volume.

² <https://www.bruker.com/en/products-and-solutions/elemental-analyzers/handheld-xrf-spectrometers/handheld-xrf-applications/alloy-identification.html>; <https://www.bruker.com/en/products-and-solutions/elemental-analyzers/handheld-xrf-spectrometers/S1-TITAN.html>.

		1. Bracelet no. 1, body	2. Bracelet no. 1, volute	3. Bracelet no. 2, body	4. Bracelet no. 2, volute	5. Bracelet no. 2, added rod	6. Bracelet no. 2, added rod, welding traces	7. Denarius, rev.	8. Denarius, obv., welding traces
<i>XRF analysis no.</i>		1037	1038	1039	1040	1041	1042	16	17
Ag	(wt%)	95.98	96.14	93.07	92.42	88.60	59.01	93.92	33.51
	<i>error (+/-)</i>	0.61	0.67	0.62	0.67	0.84	0.49	0.59	0.32
Cu	(wt%)	2.53	2.41	4.63	4.62	5.54	5.58	2.16	2.12
	<i>error (+/-)</i>	0.07	0.07	0.09	0.08	0.14	0.11	0.06	0.06
Au	(wt%)	0.87	0.77	0.98	0.71	0.34	0.40	0.78	0.31
	<i>error (+/-)</i>	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.04
Pb	(wt%)	0.32	0.46	0.98	0.47	0.68	2.63	2.92	5.95
	<i>error (+/-)</i>	0.08	0.09	0.12	0.10	0.15	0.17	0.17	0.19
Zn	(wt%)	0.11	0.05	0.19	0.10	4.09	0.27	0.03	0.11
	<i>error (+/-)</i>	0.01	0.01	0.02	0.02	0.11	0.02	0.01	0.01
As	(wt%)	0.09	0.06						
	<i>error (+/-)</i>	0.04	0.02						
Ni	(wt%)	0.09	0.09	0.08	0.09		0.08	0.08	0.07
	<i>error (+/-)</i>	0.01	0.01	0.01	0.01		0.01	0.01	0.01
Fe	(wt%)					0.51	2.52		1.72
	<i>error (+/-)</i>					0.08	0.12		0.08
Si	(wt%)					3.78			5.59
	<i>error (+/-)</i>					0.06			0.06
Sn	(wt%)						25.70		48.90
	<i>error (+/-)</i>						0.58		0.59

Table 1

The results obtained by analyzing the two bracelets show that silver is the main composing element used in the manufacturing process. These results correspond well with other similar observations from the literature³. The silver used was alloyed with a small percentage of copper, since pure silver does not have the necessary physical properties. Pure silver is known to bend, dent and wear easily. Copper was known to be a common alloying element for silver, during the late Roman period. Such an alloying element would add strength and hardness to silver. Copper may often be extracted alongside silver or gold. But in those cases, the percentage found in the analysed pieces never exceeds 1%. Any higher copper concentration may be interpreted as an intentional alloying using this element⁴.

³ Vulić *et alii* 2017; Greiff 2017; Lang, Hughes 2016; Doračić, Lang, Fletcher *et alii.* 2015; Hook, Callewaert 2013.

⁴ Hughes, Hall 1979.

Alongside these two main composing elements, traces of gold, lead, arsenic and zinc may be observed. The concentration of gold, lead and arsenic may suggest that they are naturally occurring, not added intentionally and deriving from the ores used to obtain the silver and copper that compose the items⁵. During the Roman period, the main sources of silver were the silver-bearing lead ores⁶. To obtain the silver, the ores were first roasted, melted and cupelled. The cupellation procedure usually removed most of the impurities⁷. One of the pieces is showing a small content of arsenic in its concentration, this may suggest that the cupellation process was incomplete. Ancient Romans were known to produce silver with a lead content between 0.5-1%⁸, but if the silver originated from silver-bearing lead ores (galena, anglesite or cerussite) the concentration of lead may increase up to 3%⁹. The lead content identified in the presented items falls within this range. Gold is known to be completely miscible with silver. During the metallurgical processes applied, the content of gold may change, but not in a significant way¹⁰. The literature also states that the Au/Ag ratio does not alter during cupellation¹¹. Usually, the gold content in Roman silver items falls between 0.1 and 4.5%¹².

The presence of zinc, in low percentages, may indicate an incomplete silver preparation process, as zinc may be removed from silver ore by the cupellation procedure. The percentage of zinc is significantly higher in one item, over 4%. This may indicate that the source of copper used to alloy the silver was not copper ore, but rather an unknown recycled brass item. This alloying practice became more usual during the Migration Period¹³. Though other examples are rare, other works documented other pieces having elevated concentrations of zinc, tying this to alloying with copper from brass or with brass¹⁴.

The 4077 sample (bracelet no. 2) presents an added rod, for which the chemical composition is very different with respect to the rest of the analysed bracelet areas. The percentage of silver is lower while zinc appears in the alloy's composition. Most likely, this piece was added after the bracelet was finished. On the same sample, marks of tin are visible, maybe an adhesive used to add another decoration to the bracelet. This decoration, missing from the piece, was discovered at a small distance from the bracelet. The analysis of the decoration (*denarius*) revealed a similar type of silver alloy, but with slight differences in concentration. With these values in mind, the possibility that the same alloy was used for one of these pieces cannot be taken into consideration. The coin may have been minted using a different, yet similar, type of alloy. In order to obtain relevant data regarding the coin's composing alloy, the analysis was performed on the reverse, while the spectra recorded on the obverse of the decoration showed a significant amount of tin. Considering the marks visible on this decoration, and comparing the results obtained when the similar marks from the original piece were studied, one may observe the similar type of tin alloy identified, leading to the belief that this decoration was part of the bracelet.

Although the samples were cleaned before the analysis, the results show the presence of chemical elements which, most likely, are part of the patina, not the composing alloy, since they are more characteristic to the soil. These elements are iron, nickel and silicon.

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⁵ Hughes, Hall 1979.

⁶ Tylecote 1962; Forbes 1971.

⁷ Pernicka 2014; L'Héritier *et alii* 2015.

⁸ Hughes, Hall 1979.

⁹ Moorey 1985.

¹⁰ L'Héritier *et alii* 2015.

¹¹ Pernicka 2014.

¹² Hughes, Hall 1979; Lang, Hughes 1984; Hook, Callewaert 2013.

¹³ Craddock *et alii* 2010; Horváth *et alii* 2019; Mozgai *et alii* 2019.

¹⁴ Cowell, Hook 2010; Hughes, Hall 1979.

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ABRÉVIATIONS

- AA – Archäologischer Anzeiger. Deutsches Archäologisches Institut, Berlin
(A)ARMSI – Analele Academiei Române. Memoriile Secțiunii Istorice, București
ABSA – Annual of the British School at Athens, Athens
ACMI – Anuarul Comisiunii Monumentelor Istorice, București
ActaArchHung – Acta Archaeologica Academiae Scientiarum Hungaricae, Budapest
ActaMN – Acta Musei Napocensis. Muzeul Național de Istorie a Transilvaniei, Cluj-Napoca
ActaPraehArch – Acta Praehistorica et Archaeologica, Berlin
AÉ – L'Année épigraphique, Paris
AJA – American Journal of Archaeology. The Journal of the Archaeological Institute of America
AJPh – American Journal of Philology, Baltimore
AM – Mitteilungen des Deutschen Archäologischen Instituts. Athenische Abteilung, Athen
American Anthropologist – American Anthropologist. Journal of the American Anthropological Association, ([http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1548-1433](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1548-1433))
AnaliSofia – Anali. Spisania za istorija, clasičeska kultura i iskustvoznania, Sofia
Anatolia Antiqua – Anatolia Antiqua. Revue internationale d'archéologie anatolienne. Institut français d'études anatoliennes, Istanbul
AncWestEast – Ancient West & East, Leiden
Angustia – Angustia. Arheologie, Etnografie, Sfântu Gheorghe
ANRW – *Aufstieg und Niedergang der römischen Welt. Geschichte und Kultur Roms im Spiegel der neueren Forschung*, Berlin – New York, 1972-1998
AnUBucurești – Analele Universității din București
AnUCraiova – Analele Universității din Craiova
AOR – Arheologičeski otkritija i razkopki
APL – Analecta Praehistorica Leidensia, Leiden
Apulum – Acta Musei Apulensis. Muzeul Național al Unirii, Alba Iulia
Aquitania – Aquitania. Fédération Aquitania, Bordeaux
Archaeological Journal – The Archaeological Journal. Royal Archaeological Institute, London
ArhMold – Arheologia Moldovei. Academia Română, Institutul de Arheologie, Iași
ArhSofia – Arheologija. Organ na Arheologičeskija Institut i Muzej, Sofia
ArchÉrt – Archeológiai Értesítő. A Magyar Régészeti és Művészettörténeti Társulat Tudományos Folyóirata, Budapest
ArchHung-Archaeologia Hungarica. Acta Archaeologica Musei Nationalis Hungarici, Budapest
ArchKorr – Archäologisches Korrespondenzblatt. Römisch-Germanisches Zentralmuseum, Mainz
Argesis – Argesis. Muzeul Județean Argeș, Pitești
Aristonothos – Aristonothos. Rivista di Studi sul Mediterraneo Antico, Università degli Studi di Milano
BABESCH – BABESCH. Annual Papers on Mediterranean Archaeology, Leiden
Banatica – Banatica. Muzeul Banatului Montan, Reșița
BARIntSer – British Archaeological Reports, International Series, Oxford
BayVgBl – Bayerische Vorgeschichtsblätter. Kommission für bayerische Landesgeschichte bei der Bayerischen Akademie der Wissenschaften in Verbindung mit dem Bayerischen Landesamt für Denkmalpflege und der Archäologische Staatssammlung, München
BCH – Bulletin de Correspondance Hellénique, Athènes – Paris
BerRGK – Bericht der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts, Frankfurt am Main
Berytus – Berytus. Archaeological Studies. Faculty of Arts and Sciences, American University of Beirut
BiblMusNap – Bibliotheca Musei Napocensis, Cluj-Napoca
BiblIstrPont-SA – Biblioteca Istro-Pontică. Seria Arheologie. Institutul de Cercetări Eco-Muzeale „Gavrilă Simion”, Tulcea
BiblMusAp – Bibliotheca Musei Apulensis. Muzeul Național al Unirii, Alba Iulia

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- BMTAGiurgiu – Buletinul Muzeului „Teohari Antonescu”, Giurgiu
- Britannia – Britannia. A Journal of Romano-British and Kindred Studies. Society for the Promotion of Roman Studies, Cambridge
- BSNR – Buletinul Societății Numismatice Române, București
- BSS – Black Sea Studies, Aarhus
- CA – Cercetări Arheologice. Muzeul Național de Istorie a României, București
- Caiete ARA – Caiete ARA. Arhitectură, Restaurare, Arheologie. Asociația ARA, București
- CAJ – Cambridge Archaeological Journal. McDonald Institute for Archaeological Research, University of Cambridge
- Carch – Cahiers Archéologiques. Fin de l’Antiquité et Moyen Âge, Paris
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- CEFR – Collection de l’École Française de Rome
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- CIL – *Corpus Inscriptionum Latinarum*, 17 volumes, Berlin, 1853-
- CIS – *Corpus Inscriptionum Semiticarum*, 5 volumes, Paris, 1881-1962
- ClAnt – Classical Antiquity, Berkeley, California
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- Epigraphica – Epigraphica. Periodico Internazionale di Epigrafia, Roma
- EpigrAnat – Epigraphica Anatolica. Zeitschrift für Epigraphik und historische Geographie Anatoliens, Bonn
- ÉPRO – Études préliminaires aux religions orientales dans l’Empire romain, Leiden
- EurAnt – Eurasia Antiqua. Deutsches Archäologisches Institut – Eurasien Abteilung, Berlin
- EVO – Egitto e Vicino Oriente. Rivista della sezione di Egittologia e Scienze Storiche del Vicino Oriente, Dipartimento di Civiltà e Forme del Sapere dell’Università degli studi di Pisa
- FrühMitAltSt – Frühmittelalterliche Studien. Jahrbuch des Instituts für Frühmittelalterforschung der Universität Münster, Münster
- Gephyra – Gephyra. Doğu Akdeniz Bölgesi Eskiçağ Tarihi ve Kültürlerini Araştırma Dergisi / Zeitschrift für die Geschichte und Kulturen des antiken östlichen Mittelmeerraums. Akdeniz Üniversitesi, Antalya
- Germania – Germania. Anzeiger der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts, Frankfurt am Main
- GlasnikSarajevo – Glasnik Zemaljskog Muzeja Bosne i Hercegovine, Sarajevo
- GLIHalmyris – M. Zahariade, C.-G. Alexandrescu (eds.), *Greek and Latin Inscriptions from Halmyris. Inscriptions on stone, signa, and instrumenta found between 1981 and 2010*, BARIntSer 2261, 2011
- Hesperia – Hesperia. The Journal of the American School of Classical Studies at Athens
- Historia – Historia. Zeitschrift für Alte Geschichte. Franz Steiner Verlag, Stuttgart
- Historia Urbana – Historia Urbana. Comisia de Istorie a Orașelor din România, Academia Română, Sibiu
- Histria Antiqua – Histria Antiqua. Institut društvenih znanosti Ivo Pilar, Zagreb
- HOROΣ – HOROΣ (Horos). Greek Epigraphic Society, Athens
- IDR II – G. Florescu, C.C. Petolescu (eds.), *Inscripțiile Daciei Romane / Inscriptiones Daciae Romanae*, vol. II. Oltenia și Muntenia, București, 1977

- IDR III/1 – I.I. Russu, M. Dušanić, N. Gudea, V. Wollmann (eds.), *Inscripțiile Daciei Romane / Inscriptiones Daciae Romanae*, vol. III/1. *Dacia Superior. Zona de sud-vest (teritoriul dintre Dunăre, Tisa și Mureș)*, București, 1977
- IDR III/2 – I.I. Russu, I. Piso, V. Wollmann (eds.), *Inscripțiile Daciei Romane / Inscriptiones Daciae Romanae*, vol. III/2. *Dacia Superior. Ulpia Traiana Dacica (Sarmizegetusa)*, București, 1980
- IDR III/3 – I.I. Russu, O. Floca, V. Wollmann (eds.), *Inscripțiile Daciei Romane / Inscriptiones Daciae Romanae*, vol. III/3. *Dacia Superior. Zona centrală (teritoriul dintre Ulpia Traiana, Micia, Apulum, Alburnus Maior, Valea Crișului)*, București, 1984
- IDR III/4 – I.I. Russu (ed.), *Inscripțiile Daciei Romane / Inscriptiones Daciae Romanae*, vol. III/4. *Dacia Superior. Zona răsăriteană*, București, 1988
- IDR III/5 – I. Piso (ed.), *Inscriptions d'Apulum*, Paris, 2001 (2 volumes)
- IG II² – J. Kirchner (ed.), *Inscriptiones Graecae II et III: Inscriptiones Atticae Euclidis anno posteriores*, pars I-III, 2nd edition, Berlin, 1913-1940
- IGB III/1 – G. Mihailov (ed.), *Inscriptiones graecae in Bulgaria repertae*, vol. III/1. *Inscriptiones inter Haemum et Rhodopem repertae. Fasciculus prior: Territorium Philippopolis*, Sofia, 1961
- IGLR – E. Popescu, *Inscripțiile grecești și latine din secolele IV–XIII descoperite în România*, București, 1976
- IGLS – *Inscriptions grecques et latines de la Syrie*, Paris – Beirut, 1929-2012
- IK Iznik – S. Şahin, *Katalog der antiken Inschriften des Museums von Iznik (Nikaia)*, Inschriften griechischer Städte aus Kleinasien 9 und 10, 1-2, Bonn, 1979, 1981-1982
- Il Mar Nero – Il Mar Nero. *Annali di archeologia e storia*, Roma
- ILD – C.C. Petolescu, *Inscripții latine din Dacia*, București, I (2005), II (2016)
- IMT – M. Barth, J. Stauber (eds.), *Inschriften Mysia & Troas*, München, 1993
- Inv XI – J. Teixidor, *Inventaire des inscriptions de Palmyre*, vol. 11, Beirut, 1965
- IRT – J.M. Reynolds, J.B. Ward-Perkins, *The Inscriptions of Roman Tripolitania*, Rome, 1952
- ISmyrna – G. Petzl, *Die Inschriften von Smyrna*, Inschriften griechischer Städte aus Kleinasien 23 und 24, 1-2, Bonn, 1982, 1987, 1990
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- ISM III – A. Avram, *Inscriptiones Scythiae Minoris Graecae et Latinae*, vol. III. *Callatis et territorium*, București, 1999
- ISM V – E. Doruțiu-Boilă, *Inscriptiones Scythiae Minoris Graecae et Latinae*, vol. V. *Capidava, Troesmis, Noviodunum*, București, 1980
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- IzvestijaSofia – Izvestija na Nacionalnija arheologičeski Institut, Sofia
- IzvestijaŞumen – Izvestija na Narodnija Muzej, Şumen
- JAHA – Journal of Ancient History and Archaeology, Academia Română, Institutul de Arheologie și Istoria Artei Cluj-Napoca, Universitatea Tehnică Cluj-Napoca
- JAS – Journal of Archaeological Science, Elsevier
- JDAI – Jahrbuch des Deutschen Archäologischen Instituts. Deutsches Archäologisches Institut, Berlin
- JFA – Journal of Field Archaeology, Boston University
- JHS – The Journal of Hellenic Studies. Society for the Promotion of Hellenic Studies, Cambridge University Press
- JÖAI – Jahreshefte des Österreichischen Archäologischen Institutes in Wien, Wien
- JRA – Journal of Roman Archaeology, Cambridge University Press
- JRGZM – Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz, Mainz
- JRS – Journal of Roman Studies, London
- Klio – Klio. Beiträge zur Alten Geschichte, Berlin
- LGPN I – P.M. Fraser, E. Matthews (eds.), *A Lexicon of Greek Personal Names*, vol. I. *Aegean Islands, Cyprus, Cyrenaica*, Oxford, 1987
- LGPN II – P.M. Fraser, E. Matthews (eds.), *A Lexicon of Greek Personal Names*, vol. II. *Attica*, Oxford, 1994

- LGPN V.A – T. Corsten (ed.), *A Lexicon of Greek Personal Names*, vol. V.A. *Coastal Asia Minor: Pontos to Ionia*, Oxford, 2010
- MAGW – Mitteilungen der Anthropologischen Gesellschaft in Wien
- Marisia – Marisia. Muzeul Județean Mureș, Târgu Mureș
- MCA – Materiale și Cercetări Arheologice. Academia Română, Institutul de Arheologie „Vasile Pârvan”, București
- MEFRA – Mélanges de l'École Française de Rome. Antiquité, Roma
- MN – Muzeul Național, București
- Mousaios – Mousaios. Buletin Științific al Muzeului Județean Buzău
- NCE – Nuovo Catalogo Epigrafico, Musei Capitolini
- OJA – Oxford Journal of Archaeology. School of Archaeology, University of Oxford
- Orpheus – Orpheus. Journal of Indo-European and Thracian Studies. International Council of Indo-European and Thracian Studies, Institute of Balkan Studies with Centre of Thracology, Bulgarian Academy of Sciences
- PAS – Prähistorische Archäologie in Südosteuropa. Institut für Prähistorische Archäologie, Berlin
- PAT – D.R. Hillers, E. Cussini, *Palmyrene Aramaic Texts*, Baltimore, 1996
- PBF – Prähistorische Bronzefunde. Akademie der Wissenschaften und der Literatur, Mainz, Seminar für Vor- und Frühgeschichte der Goethe-Universität Frankfurt a. M., Abteilung für Ur- und Frühgeschichtliche Archäologie des Historischen Seminars der Westfälischen Wilhelms-Universität, Münster
- Peuce S.N. – Peuce, serie nouă. Studii și cercetări de istorie și arheologie. Institutul de Cercetări Eco-Muzeale „Gavrilă Simion”, Tulcea
- Plural – Plural. History, Culture, Society. Journal of the History and Geography Department, “Ion Creangă” Pedagogical State University, Chișinău
- Pontica – Pontica. Muzeul de Istorie Națională și Arheologie, Constanța
- RA – Revue archéologique, Paris
- Razkopki i proučvanija – Razkopki i proučvanija. Nacionalen Arheologičeski Institut s Muzej, Bălgarska Akademija na Naukite, Sofia
- RCAN – Revista de cercetări arheologice și numismatice, Muzeul Municipiului București
- RE – Realencyclopädie der classischen Altertumswissenschaft, Stuttgart, 1893-
- REA – Revue des Études Anciennes. Maison de l'Archéologie, Université Bordeaux Montaigne, Pessac
- REG – Revue des Études Grecques. L'associations pour l'Encouragement des Études grecques en France, Paris
- Revue Biblique – Revue Biblique. École Biblique et Archéologique Française de Jérusalem
- Revue d'Égyptologie – Revue d'Égyptologie. Société française d'égyptologie, Paris
- RI – Revista Istorică. Academia Română, Institutul de Istorie „Nicolae Iorga”, București
- RIB – R.G. Collingwood, R.P. Wright (eds.), *The Roman Inscriptions of Britain*, vol. I-II, Oxford, 1965-1995
- RRH – Revue roumaine d'histoire. Academia Română, București
- SAA – Studia Antiqua et Archaeologica. Universitatea „Alexandru Ioan Cuza”, Iași
- Saalburg Jahrbuch – Saalburg Jahrbuch. Bericht des Saalburg Museums, Bad Homburg
- SAI – Studii și Articole de Istorie. Societatea de Științe Istorice din România, București
- Sargetia – Sargetia. Acta Musei Devensis. Muzeul Civilizației Dacice și Romane, Deva
- SB I – F. Preisigke (ed.), *Sammelbuch Griechischer Urkunden aus Ägypten*, Strassburg, 1915
- SCIV(A) – Studii și Cercetări de Istorie Veche (și Arheologie). Academia Română, Institutul de Arheologie „Vasile Pârvan”, București
- SEG – *Supplementum Epigraphicum Graecum*, Leiden 1923-1971, Amsterdam 1979-
- SNG ANS – *Sylloge Nummorum Graecorum, USA. The Collection of the American Numismatic Society*, New York, 1969
- Starinar – Starinar. Naučni časopis Arheološkog instituta u Beogradu, Beograd
- StCl – Studii Clasice, Societatea de Studii Clasice din România, București
- Studi ellenistici – Studi ellenistici, Pisa – Roma
- Studia Palmyreńskie – Studia Palmyreńskie. Polish Centre of Mediterranean Archaeology, University of Warsaw
- Sumer – Sumer. A journal of archaeology and history in Iraq, Baghdad
- SympThrac – Symposia Thracologica

- Syria – Syria. Revue d'Art Oriental et d'Archéologie, Institut français du Proche-Orient, Paris
- Talanta – Talanta. Proceedings of the Dutch Archaeological and Historical Society, Amsterdam
- Thraco-Dacica – Thraco-Dacica. Academia Română, Institutul de Arheologie „Vasile Pârvan”, București
- UPA – Universitätsforschungen zur prähistorischen Archäologie, Bonn
- VAMZ – Vjesnik Arheološkog muzeja u Zagrebu, Zagreb
- VDI – Vestnik Drevnej Istorii. Otdelenie istoriko-filologičeskikh nauk Rossijskoj Akademii Nauk, Moskva
- Xenia – Xenia. Konstanzer althistorische Vorträge und Forschungen, Konstanz am Bodensee
- Zephyrus – Zephyrus. Revista de Preistoria i Arqueologia. Universidad de Salamanca
- ZPE – Zeitschrift für Papyrologie und Epigraphik, Bonn
- ZSAK – Zeitschrift für Schweizerische Archäologie und Kunstgeschichte. Schweizerisches Nationalmuseum, Zürich

