

ARCL0098: Archaeometallurgy I: Mining and Extractive Metallurgy: Marcos Martinon-Torres

View Online



1

Tylecote, R. F. The early history of metallurgy in Europe. London: : Longman 1987.

2

Craddock, P. T. Early metal mining and production. Edinburgh: : Edinburgh University Press 1995.

3

Roberts BW, Thornton CP, editors. Archaeometallurgy in global perspective: methods and syntheses. New York: : Springer 2014. doi:10.1007/978-1-4614-9017-3

4

Bayley, J., Crossley, David W., Ponting, Matthew, et al. Metals and metalworking: a research framework for archaeometallurgy. London: : Historical Metallurgy Society 2008. <http://hist-met.org/publications/hms-occasional-publications.html>

5

Thilo R. Metals: Chemical analysis. In: Encyclopedia of archaeology. Amsterdam: : ScienceDirect 2008. 1614–20. doi:10.1016/B978-012373962-9.00188-6

6

Craddock PT. Mining and smelting in Antiquity. In: Science and the past. London: : British

Museum Press 1991. 57–73.<http://www.jstor.org/stable/10.3138/j.ctt2tv44s.9>

7

Killick David, Fenn T. Archaeometallurgy: The Study of Preindustrial Mining and Metallurgy. Annual Review Of Anthropology 2012;**41**:559–75.
doi:10.1146/annurev-anthro-092611-145719

8

Lambert JB. Metals. In: Traces of the past: unraveling the secrets of archaeology through chemistry. Reading, Mass: : Addison-Wesley 1997.
168–213.<https://contentstore.cla.co.uk//secure/link?id=b7834add-6536-e711-80c9-005056af4099>

9

Archaeometallurgy: Guidelines for best practice. Historic England.
2015.<http://historicengland.org.uk/images-books/publications/archaeometallurgy-guidelines-best-practice/>

10

Archaeometallurgy in Europe, Associazione italiana di metallurgia. Archaeometallurgy in Europe: international conference, 24-25-26 September 2003, Milan, Italy : proceedings. Milano: : Associazione italiana di metallurgia 2003.

11

Archaeometallurgy in Europe, Associazione italiana di metallurgia. Archaeometallurgy in Europe: 2nd international conference, Aquileia, Italy, 17-21 June 2007 : selected papers. Milano: : AIM 2007.

12

Cech B, Rehren T, editors. Early iron in Europe. Montagnac: : Éditions Monique Mergoïl 2014.

13

Lang, Janet, Craddock, P. T. Mining and metal production through the ages. London: : British Museum 2003.

14

Hauptmann A, Modarressi-Tehrani D, International Conference Archaeometallurgy in Europe. Archaeometallurgy in Europe III: proceedings of the 3rd international conference ; June 29 - July 1, 2011. Bochum: : Dt. Bergbau-Museum 2015.

15

Hošek J, Cleere H, Mihok L, et al. The archaeometallurgy of iron: recent developments in archaeological and scientific research. Praha: : Institute of Archaeology of the ASCR 2011.

16

Humphris J, Rehren T. The world of iron. London: : Archetype 2013.

17

Craddock, P. T., Hook, Duncan R., La Niece, Susan. Metals and mines: studies in archaeometallurgy. London: : Archetype in association with the British Museum 2007.

18

Rehren, Thilo, Mei, Jianjun. Metallurgy and civilisation: Eurasia and beyond : proceedings of the 6th International Conference on the Beginnings of the Use of Metals and Alloys (BUMA VI). London: : Archetype 2009.

19

Mitteldeutscher Archäologentag. Metals of Power – Early gold and silver [Metalle der Macht: Frühes Gold und Silber]. Halle (Saale): : Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte 2014.

20

Montero I, editor. Archaeometallurgy: Technological, Economic and Social Perspectives in Late Prehistoric Europe (TESME). Trabajos de prehistoria. Trabajos de Prehistoria 2010;**67**. doi:10.3989/tp.2010.v67.i2

21

Bayley J, Rehren T. Towards a functional and typological classification of crucibles. In: Metals and mines: studies in archaeometallurgy. London: : Archetype in association with the British Museum 2007. 46–55.

22

Paul T. Craddock. Refractories: Ceramics with a Purpose. The Old Potter's Almanack 2013;**18**:9–20.<https://journals.ub.uni-heidelberg.de/index.php/opa/article/view/11962/5817>

23

Paul T. Craddock. Refractories with a purpose II: ceramics for casting. The Old Potter's Almanack 2014;**19**:2–17.<https://journals.ub.uni-heidelberg.de/index.php/opa/article/view/14852/8729>

24

Freestone I, Tite MS. Refractories in the ancient and preindustrial world. In: High technology ceramics: past, present, and future : the nature of innovation and change in ceramic technology. Westerville, OH: : American Ceramic Society 1986. 35–63.

25

Kearns T, Martínón-Torres M, Rehren T. Metal to mould: alloy identification in experimental casting moulds using XRF. Historical metallurgy: journal of the Historical Metallurgy Society 2010;**44**:48–58.

26

Liu S, Wang K, Cai Q, et al. Microscopic study of Chinese bronze casting moulds from the Eastern Zhou period. Journal of Archaeological Science 2013;**40**:2402–14.

doi:10.1016/j.jas.2012.11.010

27

Martinón-Torres M, Rehren T. Technical Ceramics. In: Roberts BW, Thornton CP, eds. Archaeometallurgy in global perspective: methods and syntheses. New York: : Springer 2014. 107–31. <http://www.vlebooks.com/vleweb/product/openreader?id=UCL&isbn=9781461490173>

28

Rademakers FW, Rehren T. Seeing the forest for the trees: Assessing technological variability in ancient metallurgical crucible assemblages. *Journal of Archaeological Science: Reports* 2016;**7**:588–96. doi:10.1016/j.jasrep.2015.08.013

29

Rehren T. Crucibles as reaction vessels in ancient metallurgy. In: Mining and metal production through the ages. London: : British Museum 2003. 207–15.

30

Craddock P, Hook D. An economic history of the post-medieval world in 50 ingots: the British Museum collection of ingots from dated wrecks. *The British Museum Technical Research Bulletin* 2012;**6**:55–68. http://www.britishmuseum.org/research/publications/online_journals/technical_research_bulletin/bmtrb_volume_6.aspx

31

Main Archaeo-Metallurgical Bibliography.
2004. <http://users.ox.ac.uk/~salter/arch-metals/met-bib-ak.htm>

32

Abstract of International Conservation Literature. <http://aata.getty.edu/Home>

33

The Historical Metallurgy Society. <https://historicalmetallurgy.org/>

34

HMS Datasheets. <https://historicalmetallurgy.org/publications/hms-datasheets/>

35

JISCMail - ARCH-METALS List at WWW.JISCMAIL.AC.UK.
<https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=ARCH-METALS>

36

Crew, Peter, Crew, Susan. Early mining in the British Isles: proceedings of the Early Mining Workshop at Plas Tan y Bwlch, Snowdonia National Park Study Centre, 17-19 November, 1989. Tan y Bwlch, Gwynedd: : Plas Tan y Bwlch, Snowdonia National Park Study Centre 1990.

37

Knapp, Arthur Bernard, Piggott, Vincent C., Herbert, Eugenia W. Social approaches to an industrial past: the archaeology and anthropology of mining. London: : Routledge 1998.

38

O'Brien, William. Bronze age copper mining in Britain and Ireland. Princes Risborough: : Shire 1996.

39

Piggott VC, Weisgerber G. Mining archaeology in geological context. The prehistoric copper mining complex at Phu Lon, Nong Khai Province, northeast Thailand. In: Metallurgica Antiqua: in honour of Hans-Gert Bachmann and Robert Maddin. Bochum: : Deutsches Bergbau-Museum 1998. 69-76.

40

Timberlake S. Early mining research in Britain: The Development of the last Ten Years. In: Mining and metal production through the ages. London: : British Museum 2003. 22–42. <https://contentstore.cla.co.uk//secure/link?id=3ee2dbf2-6336-e711-80c9-005056af4099>

41

Timberlake, Simon, Mighall, Tim. Excavations on Copa Hill, Cwmystwyth (1986-1999): an early Bronze Age copper mine within the uplands of Central Wales. Oxford: : Archaeopress 2003. doi:<https://doi.org/10.30861/9781841714868>

42

Craddock P. The development of early mining geology. In: Early metal mining and production. Edinburgh: : Edinburgh University Press 1995. 23–31. <https://contentstore.cla.co.uk/secure/link?id=ad40b8ab-6836-e711-80c9-005056af4099>

43

Agricola, Georgius, Hoover, Lou Henry, Hoover, Herbert. De re metallica. London: : The Mining magazine 1912. <http://archive.org/details/georgiusagricola00agrich>

44

Shackleton WG. Introduction and Chapter 1, Mineral deposits. In: Economic and applied geology: an introduction. London: : Croom Helm 1986. 1–18.

45

Edwards, Richard, Atkinson, Keith. Ore deposit geology and its influence on mineral exploration. London: : Chapman and Hall 1986.

46

Rehder J. High temperature technology in antiquity. In: The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy', Bochum 1995.

Bochum: : Deutsches Bergbau-Museum 1999. 305–15.

47

Rehren Th. Ores from the ore washeries in the Lavriotiki. *Metalla: Forschungsberichte des Deutschen Bergbau-Museums* 2002;**9**:27–46.

48

Rostoker W, Pigott V, Dvorak JR. Direct reduction to copper metal by oxide-sulfide mineral interaction. *Archeomaterials* 1989;**3**:69–87.

49

Artioli G, Angelini I, Tecchiati U, et al. Eneolithic copper smelting slags in the Eastern Alps: Local patterns of metallurgical exploitation in the Copper Age. *Journal of Archaeological Science* 2015;**63**:78–83. doi:10.1016/j.jas.2015.08.013

50

Paul T. Craddock. From Hearth to Furnace : Evidences for the Earliest Metal Smelting Technologies in the Eastern Mediterranean. *Paléorient* 2000;**26**:151–65.<http://www.jstor.org/stable/41496588>

51

Chernykh, E. N. *Ancient metallurgy in the USSR: the early metal age*. Cambridge: : Cambridge University Press 1991.

52

Craddock Paul. Paradigms of metallurgical innovation in prehistoric Europe. In: *The Beginnings of Metallurgy*. Bochum: : Deutsches Bergbau-Museum 1999. 175–92.

53

Golden J, Levy TE, Hauptmann A. Recent Discoveries Concerning Chalcolithic Metallurgy at

Shiqmim, Israel. *Journal of Archaeological Science* 2001;**28**:951–63.
doi:10.1006/jasc.2000.0626

54

Hauptmann, Andreas. *The archaeometallurgy of copper: evidence from Faynan, Jordan*. Berlin: : Springer 2007. <https://doi-org.libproxy.ucl.ac.uk/10.1007/978-3-540-72238-0>

55

Hoppner B, Bartelheim M, Huijsmans M, et al. Prehistoric copper production in the Inn Valley (Austria), and the earliest copper in central Europe. *Archaeometry* 2005;**47**:293–315. doi:10.1111/j.1475-4754.2005.00203.x

56

Killick D. Science, Speculation and the Origins of Extractive Metallurgy. In: *Handbook of archaeological sciences*. Chichester: : John Wiley 2001. 483–92. <https://contentstore.cla.co.uk//secure/link?id=9f2e5eae-5736-e711-80c9-005056af4099>

57

Maddin R, Muhly JD, Stech T. Early metalworking at Cayonu. In: *The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy'*, Bochum 1995. Bochum: : Deutsches Bergbau-Museum 1999. 37–44.

58

Mei J. Early metallurgy in China: some challenging issues in current studies. In: *Metallurgy and civilisation: Eurasia and beyond : proceedings of the 6th International Conference on the Beginnings of the Use of Metals and Alloys (BUMA VI)*. London: : Archetype 2009. 9–16.

59

Murillo-Barroso M, Montero-Ruiz I. Copper Ornaments in the Iberian Chalcolithic: Technology versus Social Demand. *Journal of Mediterranean Archaeology* 2012;**25**:53–73. doi:10.1558/jmea.v25i1.53

60

Murillo-Barroso M, Martínón-Torres M, Massieu MDC, et al. Early metallurgy in SE Iberia. The workshop of Las Pilas (Mojácar, Almería, Spain). *Archaeological and Anthropological Sciences* 2017;**9**:1539–69. doi:10.1007/s12520-016-0451-8

61

Pernicka E, Begemann F, Schmitt-Strecker S. Eneolithic and Early Bronze Age copper artefacts from the Balkans and their relation to Serbian copper ores. *Præhistorische Zeitschrift* 1993;**68**:1–54. doi:10.1515/prhz.1993.68.1.1

62

Pigott VC, Ciarla R. On the origins of metallurgy in prehistoric Southeast Asia: the view from Thailand. In: *Metals and mines: studies in archaeometallurgy*. London: : Archetype in association with the British Museum 2007. 76–88. <https://contentstore.cla.co.uk/secure/link?id=b2d980d9-9136-e711-80c9-005056af4099>

63

Pryce TO, Pollard M, Martinon-torres M, et al. SouthEast Asia's first isotopically defined prehistoric copper production system: when did extractive metallurgy begin in the Khao Wong Prachan Valley of central Thailand? *Archaeometry* 2011;**53**:146–63. doi:10.1111/j.1475-4754.2010.00527.x

64

Radivojevic R, Rehren T, Pernicka E. On the origins of extractive metallurgy: new evidence from Europe. *Journal of archaeological science* 2010;**37**:2775–87. doi:10.1016/j.jas.2010.06.012

65

Radivojevic M, Rehren T, Kuzmanović Cvetković J, et al. Tainted ores and the rise of tin bronzes in Eurasia, c. 6500 years ago. *Antiquity* 2013;**87**:1030–45. doi:10.1017/S0003598X0004984X

66

Benjamin W. Roberts. Production Networks and Consumer Choice in the Earliest Metal of Western Europe. *Journal of World Prehistory* 2009;**22**:461–81.<http://www.jstor.org/stable/25801284>

67

Roberts B. Ancient technologies and archaeological cultures: understanding the earliest metals in Eurasia. In: *Investigating archaeological cultures: material culture, variability, and transmission*. New York: : Springer 2011. 137–50.<http://www.vlebooks.com/vleweb/product/openreader?id=UCL&isbn=9781441969705>

68

Roberts BW, Thornton CP, Pigott V. Development of metallurgy in Eurasia. *Antiquity* 2009;**83**:1012–22.<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9437996&fileId=S0003598X00099312>

69

Rothenberg B. Smelting furnaces and installations from the New Kingdom to the Early Islamic Period. In: *The Ancient metallurgy of copper: archaeology, experiment, theory*. London: : Institute for Archaeo-Metallurgical Studies [and] Institute of Archaeology, University College, London 1990. 8–73.<https://contentstore.cla.co.uk//secure/link?id=5ea152e0-7536-e711-80c9-005056af4099>

70

Ruiz-Taboada A, Montero-Ruiz I. The oldest metallurgy in western Europe. *Antiquity* 1999;**73**:897–903.<http://search.proquest.com/docview/217555766/fulltext?accountid=14511>

71

Stech T. Neolithic copper metallurgy in South West Asia. *Archeomaterials* 1990;**4**:55–61.

72

Stech T. Aspects of early metallurgy in Mesopotamia and Anatolia. In: The archaeometallurgy of the Asian old world. Philadelphia: : Museum University of Pennsylvania 1999. 59–71.

73

Wayman ML, Duke MJM. The effects of melting on native copper. In: The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy', Bochum 1995. Bochum: : Deutsches Bergbau-Museum 1999. 55–60.

74

Bass G. Prolegomena to a study of maritime traffic in raw materials to the Aegean during the 14th and 13th centuries BC. In: *Techne: craftsmen, craftswomen and craftsmanship in the Aegean Bronze Age* : proceedings of the 6th International Aegean Conference/6e Rencontre égéenne internationale Philadelphia, Temple University, 18-21 April 1996. Liège: : Université de Liège 1997. 153–70.

75

Begemann F, Kallas K, Schmitt-Strecker S, et al. Tracing ancient tin via isotope analyses. In: The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy', Bochum 1995. Bochum: : Deutsches Bergbau-Museum 1999. 277–84.

76

Branigan, Keith. *Aegean metalwork of the Early and Middle Bronze Age*. Oxford: : Clarendon Press 1974.

77

Craddock PT, Meeks ND. Iron in Ancient Copper. *Archaeometry* 1987;**29**:187–204.
doi:10.1111/j.1475-4754.1987.tb00411.x

78

Crew P. The iron and copper slags at Baratti, Populonia, Italy. *Historical metallurgy: journal of the Historical Metallurgy Society* 1991;**25**:109–15. <http://link.springer.com/article/10.1007%2Fs12520-010-0043-y>

79

Diaz-Andreu M, Montero I. Metallurgy and social dynamics in the later prehistory of Mediterranean Spain. In: *Metals make the world go round: the supply and circulation of metals in Bronze Age Europe : proceedings of a conference held at the University of Birmingham in June 1997*. Oxford: : Oxbow 2000. 116–32. <https://contentstore.cla.co.uk//secure/link?id=9e47c996-8136-e711-80c9-005056af4099>

80

Fang JL, McDonnell G. The colour of copper alloys. *Historical metallurgy: journal of the Historical Metallurgy Society* 2011;**45**:52–61. <https://contentstore.cla.co.uk//secure/link?id=fcb26fdc-4a36-e711-80c9-005056af4099>

81

Gale, N. H. *Bronze age trade in the Mediterranean*. Jonsered: : Åström 1991.

82

Gale N. Archaeology, science-based archaeology and the Mediterranean Bronze Age metals trade: a contribution to the debate. *European Journal of Archaeology* 2001;**4**:113–30. doi:10.1179/eja.2001.4.1.113

83

Gale NH, Stos-Gale z, Raduncheva A. Early metallurgy in Bulgaria. In: *Mining and metal production through the ages*. London: : British Museum 2003. 122–73.

84

Georgakopoulou M, Bassiakos Y, Philaniotou O. Seriphos surfaces: A study of copper slag heaps and copper sources in the context of early Bronze Age Aegean metal production. *Archaeometry* 2011;**53**:123–45. doi:10.1111/j.1475-4754.2010.00529.x

85

Giumlia-Mair, Alessandra R., Lo Schiavo, Fulvia. The problem of early tin. Oxford: : Archaeopress 2003. doi:<https://doi.org/10.30861/9781841715643>

86

Bryan Hanks and Roger Doonan. From Scale to Practice: A New Agenda for the Study of Early Metallurgy on the Eurasian Steppe. *Journal of World Prehistory* 2009;**22**:329–56.<http://www.jstor.org/stable/25801279>

87

Hauptmann A, Rehren Th, Schmitt-Strecker S. Early Bronze Age copper metallurgy at Shahr-i Sokhta (Iran), reconsidered. In: *Man and mining: Mensch und Bergbau : studies in honour of Gerd Weisgerber on occasion of his 65th birthday*. Bochum: : Deutsches Bergbau-Museum 2003. 197–213.

88

Hauptmann A. Developments in copper metallurgy during the fourth and third millennia BC at Feinan, Jordan. In: *Mining and metal production through the ages*. London: : British Museum 2003. 90–100.

89

Haustein M, Gillis C, Pernicka E. Tin isotopy - A new method for solving old questions. *Archaeometry* 2010;**52**:816–32. doi:10.1111/j.1475-4754.2010.00515.x

90

Hunt Ortiz, Mark A. Prehistoric mining and metallurgy in South West Iberian Peninsula. Oxford: : Archaeopress 2003. doi:<https://doi.org/10.30861/9781841715544>

91

Keswani PS. Death, Prestige, and Copper in Bronze Age Cyprus. *American journal of archaeology* 2005;**109**:341–401.<http://www.jstor.org/stable/40026118>

92

Laughlin GJ, Todd JA. Evidence for Early Bronze Age tin ore processing. *Materials Characterization* 2000;**45**:269–73. doi:10.1016/S1044-5803(00)00111-X

93

Liu S, Rehren T, Pernicka E, et al. Copper processing in the oases of northwest Arabia: technology, alloys and provenance. *Journal of Archaeological Science* 2015;**53**:492–503. doi:10.1016/j.jas.2014.10.030

94

Levy et al. TE. Early Bronze Age metallurgy: a newly discovered copper manufactory in southern Jordan. *Antiquity* 2002;**76**:425–37. doi:10.1017/S0003598X00090530

95

Roger Matthews and Hassan Fazeli. Copper and Complexity: Iran and Mesopotamia in the Fourth Millennium B.C. *Iran: journal of the British Institute of Persian Studies* 2004;**42**:61–75.<http://www.jstor.org/stable/4300663>

96

Martinón-Torres M, Rehren T. Technical Ceramics. In: Roberts BW, Thornton CP, eds. *Archaeometallurgy in global perspective: methods and syntheses*. New York: : Springer 2014. 107–31.<http://www.vlebooks.com/vleweb/product/openreader?id=UCL&isbn=9781461490173>

97

Moorey PRS. Metalworking: 3. Base metals, part iii: copper and its alloys. In: *Ancient Mesopotamian materials and industries: the archaeological evidence*. Oxford: : Clarendon

Press 1994.

242–78. <https://contentstore.cla.co.uk//secure/link?id=f20e44c9-4c36-e711-80c9-005056af4099>

98

Muhly J. Copper and bronze in Cyprus and the Eastern Mediterranean. In: The archaeometallurgy of the Asian old world. Philadelphia: : Museum University of Pennsylvania 1999. 15–25.

99

Müller R, Rehren Th, Rovira S. Almizaraque and the early copper metallurgy of southeast Spain: new data. *Madrider Mitteilungen* 2004;**45**:33–56.

100

Nezafati N, Pernicka E, Momenzadeh M. Ancient Tin: Old Question and New Answer. 2006. <http://www.cais-soas.com/CAIS/Science/tin.htm>

101

Nocete. et al F. The smelting quarter of Valencina de la Concepción (Seville, Spain): the specialised copper industry in a political centre of the Guadalquivir Valley during the third millennium BC (2750-2500 BC). *Journal of Archaeological Science* 2008;**35**:717–32. doi:10.1016/j.jas.2007.05.019

102

O'Brien W. Resource availability and metal supply in the insular Bronze Age. In: The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy', Bochum 1995. Bochum: : Deutsches Bergbau-Museum 1999. 227–35.

103

Ottaway B. Innovation, production and specialization in early Prehistoric copper metallurgy. *European Journal of Archaeology* 2001;**4**:87–112. doi:10.1179/eja.2001.4.1.87

104

Ottaway BS, Seibel S. Dust in the wind: experimental casting of bronze in sand moulds. In: *Paléoméallurgie des cuivres: actes du colloque de Bourg-en-Bresse et Beaune, 17-18 octobre 1997*. Montagnac: : M. Mergoil 1998. 59–63.

105

Pare, C. F. E. *Metals make the world go round: the supply and circulation of metals in Bronze Age Europe*. Oxford: : Oxbow 2000.

106

Pearce, Mark. Reconstructing prehistoric metallurgical knowledge: the northern Italian Copper and Bronze Ages. *European Journal of Archaeology* 1998;**1**:51–70.
doi:10.1179/eja.1998.1.1.51

107

Penhallurick, R. D., Institute of Metals. *Tin in antiquity: its mining and trade throughout the ancient world with particular reference to Cornwall*. London: : Institute of Metals 1986.

108

Phelps, William W., Lólos, Yannis, Vēchos, Giannēs, et al. *The Point Iria wreck: interconnections in the Mediterranean, ca. 1200 BC*. 2nd ed. Athens: : Hellenic Institute of Marine Archaeology 1999.

109

Pigott VC. Reconstructing the copper production process as practised among prehistoric mining/metallurgical communities in the Khao Wong Prachan Valley of central Thailand. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. 10–21.
doi:<https://doi.org/10.30861/9781841710082>

110

Pryce TO, Pigott VC, Martín-Torres M, et al. Prehistoric copper production and technological reproduction in the Khao Wong Prachan Valley of Central Thailand. *Archaeological and Anthropological Sciences* 2010;**2**:237–64.
doi:10.1007/s12520-010-0043-y

111

Pulak C. The copper and tin ingots from the Late Bronze Age shipwreck at Uluburnun. In: *Anatolian metal I*. Bochum: : Deutsches Bergbau-Museum 2000. 137–57.

112

Rehren Th, Hess K, Philip G. Fourth millennium BC copper metallurgy in Northern Jordan: The evidence from Tell esh-Shuna. In: *The prehistory of Jordan, II: perspectives from 1997*. Berlin: : Ex Oriente 1997. 625–40.

113

Renfrew, C. Cycladic Metallurgy and the Aegean Early Bronze Age. *American Journal of Archaeology* 1967;**71**:1–20.<http://www.jstor.org/stable/501585>

114

Rehren T, Boscher L, Pernicka E. Large scale smelting of speiss and arsenical copper at Early Bronze Age Arisman, Iran. *Journal of Archaeological Science* 2012;**39**:1717–27.
doi:10.1016/j.jas.2012.01.009

115

Rohl B, Needham S. Lead isotope and chemical composition variation in ores and metals. In: *The circulation of metal in the British Bronze Age: the application of lead isotope analysis*. London: : British Museum 1998.
3–8.<https://contentstore.cla.co.uk//secure/link?id=013deb7a-7336-e711-80c9-005056af4099>

116

Segal I, Rothenberg B, Bar-Matthews M. Smelting slag from prehistoric Site F2 and N3 in Timna, SW Arabah, Israel. In: *Metallurgica Antiqua: in honour of Hans-Gert Bachmann and*

Robert Maddin. Bochum: : Deutsches Bergbau-Museum 1998. 223–34.

117

Shennan S. Cost, benefit and value in the organization of early European copper production. *Antiquity* 1999;**73**:352–63.
<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9434845&fulltextType=RA&fileId=S0003598X0008830X>

118

Stos-Gale S, Macdonald C. Sources of metals and trade in the Bronze Age Aegean. In: *Bronze age trade in the Mediterranean: papers presented at the Conference held at Rewley House, Oxford, in December 1989*. Jonsered: : Åström 1991. 249–88.

119

Thornton CP, Rehren T, Pigott VC. The production of speiss (iron arsenide) during the Early Bronze Age in Iran. *Journal of Archaeological Science* 2009;**36**:308–16.
doi:10.1016/j.jas.2008.09.017

120

Weeks, Lloyd R. *Early metallurgy of the Persian Gulf: technology, trade, and the Bronze Age World*. Boston: : Brill 2004.

121

Weisgerber G, Yule P. Al-Aqir near Bahla' - an Early Bronze Age dam site with planoconvex 'copper' ingots. *Arabian Archaeology and Epigraphy* 2003;**14**:24–53.
doi:10.1034/j.1600-0471.2003.00003.x

122

Pulak, Cemal, Slotta, Rainer, Yalçın, Ünsal, et al. *Das Schiff von Uluburun: Welthandel vor 3000 Jahren : Katalog der Ausstellung des Deutschen Bergbau-Museums Bochum vom 15. Juli 2005 bis 16. Juli 2006*. Bochum: : Deutsches Bergbau-Museum 2005.

123

Yener, K. Aslihan. The domestication of metals: the rise of complex metal industries in Anatolia. Leiden: : Brill 2000.

124

Yener KA, Adriaens A, Earl B, et al. Analyses of metalliferous residue, crucible fragments, experimental smelts, and ores from Kestel tin mine and the tin processing site of Goltepe, Turkey. In: Mining and metal production through the ages. London: : British Museum 2003. 181–97.

125

Anguilano L, Rehren Th, Muller W, et al. Roman Jarosite exploitation at Riotinto(Spain). In: Archaeometallurgy in Europe: 2nd international conference, Aquileia, Italy, 17-21 June 2007 : selected papers. Milano: : AIM 2009. 21–9.

126

Bartelheim M, Contreras Cortés F, Moreno Onorato A, et al. The silver of the South Iberian El Argar Culture: A first look at production and distribution. Trabajos de Prehistoria 2012;**69**:293–309. doi:10.3989/tp.2012.12093

127

Cohen CR, Rehren Th, Van Buren M. An archaeo-metallurgical study of the use of European furnaces in colonial Bolivia. In: Archaeometallurgy in Europe: 2nd international conference, Aquileia, Italy, 17-21 June 2007 : selected papers. Milano: : AIM 2009. 529–40.

128

Bayley J. Medieval precious metal refining: archaeology and contemporary texts compared. In: Archaeology, history and science: integrating approaches to ancient materials. Walnut Creek, CA: : Left Coast Press 2008. 131–50.<http://UCL.ebib.com/patron/FullRecord.aspx?p=677776>

129

Boni M, Maio GD, Frei R, et al. Lead isotopic evidence for a mixed provenance for Roman water pipes from Pompeii. *Archaeometry* 2000;**42**:201–8.
doi:10.1111/j.1475-4754.2000.tb00876.x

130

Cochet, André, Pernot, Michel. *Le plomb en Gaule romaine: techniques de fabrication et produits*. Montagnac: : Monique Mergoïl 2000.

131

Cohen CR, Rehren T, Van Buren M. When the wind blows: environmental adaptability in current day silver production within the Bolivian Andes. In: *Proceedings: ISA 2006 : 36th International Symposium on Archaeometry : 2-6 May 2006, Quebec City, Canada*. Québec: : CELAT, Université Laval 2009. 465–75.

132

Craddock P, Catwright C, Eckstein K, et al. Simple sophistication: Mauryan silver production in North West India. *British Museum Technical Research Bulletin* 7. 2013;:79–93.http://www.britishmuseum.org/research/publications/online_journals/technical_research_bulletin/bmtrb_volume_7.aspx

133

Durali-Mueller S, Brey GP, Wigg-Wolf D, et al. Roman lead mining in Germany: its origin and development through time deduced from lead isotope provenance studies. *Journal of Archaeological Science* 2007;**34**:1555–67. doi:10.1016/j.jas.2006.11.009

134

Hunter F, Davis M. Early Bronze Age lead — a unique necklace from southeast Scotland. *Antiquity* 1994;**68**:824–30.<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9423224&fulltextType=RA&fileId=S0003598X00047529>

135

Liu S, Rehren T, Chen J, et al. Bullion production in imperial China and its significance for

sulphide ore smelting world-wide. *Journal of Archaeological Science* 2015;**55**:151–65.
doi:10.1016/j.jas.2014.12.023

136

Martinón-Torres Marcos, Thomas N, Rehren Th, et al. Some problems and potentials of the study of cupellation remains: the case of post-medieval Montbéliard. *ArcheoSciences: Revue d'Archeometrie* 2008;**32**:59–70.<http://archeosciences.revues.org/948>

137

Martinon-Torres M, Rehren T, Thomas N, et al. Identifying materials recipes and choices: some suggestions for the study of archaeological cupels. *Archaeometallurgy in Europe: 2nd international conference, Aquileia, Italy, 17-21 June 2007 : selected papers* 2009.

138

Murphy S, Baldwin H. Early lead smelting sites in the Swaledale area of Yorkshire. *Historical metallurgy: journal of the Historical Metallurgy Society* 2001;**35**:1–22.<https://contentstore.cla.co.uk//secure/link?id=ac98f2d5-4a36-e711-80c9-005056af4099>

139

Merkel JF. Imperial Roman production of lead and silver in the northern part of Upper Moesia (Mt. Kosmaj area). *Glasnik: Srpsko arheološko društvo* 2007;:39–78.

140

Pernicka E, Rehren T, Schmitt-Strecker S. Late Uruk silver production by cupellation at Habuba Kabira, Syria. In: *Metallurgica Antiqua: in honour of Hans-Gert Bachmann and Robert Maddin*. Bochum: : Deutsches Bergbau-Museum 1998. 123–34.

141

Ploquin A, Bailly-Maitre M-C, Allee P, editors. Mines et metallurgies anciennes du plomb dans leurs environnements. Apports des methodes contribuant a leur etude. Special issue of *ArcheoSciences: Revue d'Archeometrie* 2010;**34**.<http://archeosciences.revues.org/2574>

142

Rehren T, Prange M. Lead metal and patina: a comparison. In: *Metallurgica Antiqua: in honour of Hans-Gert Bachmann and Robert Maddin*. Bochum: : Deutsches Bergbau-Museum 1998. 183–96.

143

Rehren T, Schneider J, Bartels C. Medieval lead-silver smelting in the Siegerland, West Germany. In: *Historical metallurgy: journal of the Historical Metallurgy Society*. Sheffield: : Historical Metallurgy Society 1999. 73–84. <https://contentstore.cla.co.uk//secure/link?id=ae98f2d5-4a36-e711-80c9-005056af4099>

144

Rehren T. The production of silver in South America. *Archaeology international* 2011;**13/14**:76–86. doi:10.5334/ai.1318

145

Schultze CA, Stanish C, Scott DA, et al. Direct evidence of 1,900 years of indigenous silver production in the Lake Titicaca Basin of Southern Peru. *Proceedings of the National Academy of Sciences* 2009;**106**:17280–3. doi:10.1073/pnas.0907733106

146

Mary Van Buren, Barbara H. Mills. Huayrachinas and Toco chimbos: Traditional Smelting Technology of the Southern Andes. *Latin American Antiquity* 2005;**16**:3–25. doi:10.2307/30042484

147

Wood JR, Charlton MF, Murillo-Barroso M, et al. Iridium to provenance ancient silver. *Journal of Archaeological Science* 2017;**81**:1–12. doi:10.1016/j.jas.2017.03.002

148

Pernicka E. Provenance and recycling of ancient silver. A comment on "Iridium to

provenance ancient silver" by Jonathan R. Wood*, Michael F. Charlton, Mercedes Murillo-Barroso, Marcos Martín-Torres. J. Archaeol. Sci. 81, 1–12. Journal of Archaeological Science Published Online First: August 2017. doi:10.1016/j.jas.2017.07.004

149

Wood JR, Charlton MF, Murillo-Barroso M, et al. Gold parting, iridium and provenance of ancient silver: A reply to Pernicka. Journal of Archaeological Science Published Online First: August 2017. doi:10.1016/j.jas.2017.07.005

150

Wyttenbach A, Schubiger PA. Trace element content of Roman lead by neutron activation analysis. Archaeometry 1973;**15**:199–207. doi:10.1111/j.1475-4754.1973.tb00090.x

151

Zori C, Tropper P. Silver lining: evidence for Inka silver refining in northern Chile. Journal of Archaeological Science 2013;**40**:3282–92. doi:10.1016/j.jas.2013.03.020

152

Alipour R, Rehren T. Persian Pulād Production: Chāhak Tradition. Journal of Islamic Archaeology 2014;**1**:231–61. doi:10.1558/jia.v1i2.24174

153

Benoit, Paul, Fluzin, Philippe. Paléoméallurgie du fer et Cultures. Paris: : Association pour l'Édition et la Diffusion des Études Historiques 1995.

154

Biggs L, Bellina B, Martín-Torres M, et al. Prehistoric iron production technologies in the Upper Thai-Malay Peninsula: metallography and slag inclusion analyses of iron artefacts from Khao Sam Kaeo and Phu Khao Thong. Archaeological and Anthropological Sciences 2013;**5**:311–29. doi:10.1007/s12520-012-0115-2

155

Blakelock E, Martín-Torres M, Veldhuijzen HA, et al. Slag inclusions in iron objects and the quest for provenance: an experiment and a case study. *Journal of Archaeological Science* 2009;**36**:1745–57. doi:10.1016/j.jas.2009.03.032

156

Buchwald, Vagn Fabritius, Kongelige Danske videnskabernes selskab. Iron and steel in ancient times. Copenhagen: : Det Kongelige Danske Videnskabernes Selskab 2005.

157

Cech B, Rehren T, editors. Early iron in Europe. Montagnac: : Éditions Monique Mergoil 2014.

158

Cleere H. Ironmaking in the economy of the ancient world: The potential of archaeometallurgy. In: The Crafts of the blacksmith. [Belfast?]: : UISPP Comité pour la Sidérurgie Ancienne and the Ulster Museum 1984. 1–6.

159

Charlton MF, Crew P, Rehren T, et al. Explaining the evolution of ironmaking recipes – An example from northwest Wales. *Journal of Anthropological Archaeology* 2010;**29**:352–67. doi:10.1016/j.jaa.2010.05.001

160

Charlton MF, Blakelock E, Martín-Torres M, et al. Investigating the production provenance of iron artifacts with multivariate methods. *Journal of Archaeological Science* 2012;**39**:2280–93. doi:10.1016/j.jas.2012.02.037

161

Craddock, P. T. Early metal mining and production. Edinburgh: : Edinburgh University Press 1995.

162

Crew P. The experimental production of prehistoric bar iron. *Historical metallurgy: journal of the Historical Metallurgy Society* 1991;**25**:21–36.<https://contentstore.cla.co.uk//secure/link?id=b298f2d5-4a36-e711-80c9-005056af4099>

163

Crew P. Aspects of the iron supply. In: *Danebury: an Iron Age hillfort in Hampshire, Vol.6: A hillfort community in perspective*. London: : Council for British Archaeology 1995. 276–86.<https://contentstore.cla.co.uk//secure/link?id=5d25630c-8e36-e711-80c9-005056af4099>

164

Dieudonne-Glad N, Conte P. Smithing at the priory of Lavinadiere, Correze, France, 13th and 16th centuries. *Historical metallurgy: journal of the Historical Metallurgy Society* 2011;**45**:1–7.

165

Dungworth D, Mephram L. Prehistoric iron smelting in London: evicence from Shooters Hill. *Historical metallurgy: journal of the Historical Metallurgy Society* 2012;**46**:1–8.

166

Gassmann G. Recent discoveries and excavations of 6th -2nd century BC furnaces in SW Germany. *Historical metallurgy: journal of the Historical Metallurgy Society* 2002;**36**:71–7.<https://contentstore.cla.co.uk//secure/link?id=af98f2d5-4a36-e711-80c9-005056af4099>

167

Hendrickson M. A transport geographic perspective on travel and communication in Angkorian Southeast Asia (ninth to fifteenth centuries). *World Archaeology* 2011;**43**:444–57. doi:10.1080/00438243.2011.605846

168

Hošek J, Cleere H, Mihok L, et al. The archaeometallurgy of iron: recent developments in archaeological and scientific research. Praha: : Institute of Archaeology of the ASCR 2011.

169

Huang X, Qian W, Wei W, et al. 3D numerical simulation on the flow field of single tuyere blast furnaces: A case study of the Shuiquangou iron smelting site dated from the 9th to 13th century in China. *Journal of Archaeological Science* 2015;**63**:44-58.
doi:10.1016/j.jas.2015.08.009

170

Humphris, Jane, Rehren, Thilo. The world of iron. London: : Archetype 2013.

171

Joosten, Ineke. Technology of early historical iron production in the Netherlands. Amsterdam: : Institute for Geo- and Bioarchaeology, Vrije Universiteit 2004.

172

Lang J. Roman iron and steel: A review. *Materials and Manufacturing Processes* 2017;**32**:857-66. doi:10.1080/10426914.2017.1279326

173

Martinon-Torres M, Rehren T. Analytical study of iron slag from the Novgorod hinterland. In: The archaeology of medieval Novgorod in context: studies in centre/periphery relations. Oxford: : Oxbow 2008.
185-94. https://ucl.primo.exlibrisgroup.com/discovery/fulldisplay?docid=cdi_proquest_ebookcentralchapters_5846057_19_9&context=PC&vid=44UCL_INST:UCL_VU2&lang=en&search_scope=MyInst_and_CI&adaptor=Primo%20Central&tab=Eeverything&query=any,contains,Analytical%20study%20of%20iron%20slag%20from%20the%20Novgorod%20hinterland

174

Nørbach, Lars Christian. Prehistoric and medieval direct iron smelting in Scandinavia and Europe: aspects of technology and society. Aarhus: : Aarhus University Press 2003.

175

Park J-S, Rehren T. Large-scale 2nd to 3rd century AD bloomery iron smelting in Korea. Journal of Archaeological Science 2011;**38**:1180–90. doi:10.1016/j.jas.2010.12.007

176

Paynter S. Regional variations in bloomery smelting slag of the Iron Age and Romano-British periods. Archaeometry 2006;**48**:271–92.
doi:10.1111/j.1475-4754.2006.00256.x

177

Paynter S. Romano-British workshops for iron smelting and smithing at Westhawk Farm, Kent. Historical metallurgy: journal of the Historical Metallurgy Society;**41**:15–31.

178

Paynter S. Innovations in bloomery smelting in iron Age and Romano-British England. In: Metals and mines: studies in archaeometallurgy. London: : Archetype in association with the British Museum 2007. 202–10.

179

Pleiner, Radomír. Iron in archaeology: the European bloomery smelters. Praha: : Archeologický ústav AVČR 2000.

180

Pleiner, Radomír. Iron in archaeology: early European blacksmiths. Praha: : Archeologický ústav AV ČR 2006.

181

Pryce, T. O. Natapintu, S. Smelting Iron from Laterite: Technical Possibility or Ethnographic Aberration? *Journal of Archeology for Asia & the Pacific* 2009;**48**:249–64. <http://www.jstor.org/stable/42928763>

182

Rehren Th, Papakhristu O. Cutting edge technology – The Ferghana Process of medieval crucible steel smelting. *Metalla: Forschungsberichte des Deutschen Bergbau-Museums* 2000;**7**:55–69.

183

Rostoker, William, Bronson, Bennet. Pre-industrial iron: its technology and ethnology. Philadelphia, Pa: : [Archeomaterials] 1990.

184

Rovira S, Lopez-Medina M, Roman-Diaz MP, et al. Los Callejones: a Roman Republican iron mining and smelting centre in the south east of the Iberian Peninsula. *Historical metallurgy: journal of the Historical Metallurgy Society* 2004;**38**:1–9. <https://contentstore.cla.co.uk//secure/link?id=b198f2d5-4a36-e711-80c9-005056af4099>

185

Sim, David, Ridge, Isabel. Beyond the bloom: bloom refining and iron artifact production in the Roman world. Oxford: : Archaeopress 1998.
doi:<https://doi.org/10.30861/9780860549017>

186

Tylecote RF. Forging and hammering techniques. In: *The early history of metallurgy in Europe*. London: : Longman 1987.
243–79. <https://contentstore.cla.co.uk//secure/link?id=923ea999-5d36-e711-80c9-005056af4099>

187

Rehren T, Belgya T, Jambon A, et al. 5,000 years old Egyptian iron beads made from

hammered meteoritic iron. *Journal of Archaeological Science* 2013;**40**:4785–92.
doi:10.1016/j.jas.2013.06.002

188

Veldhuijzen HA, Rehren Th. Slags and the city: early iron production at Tell Hammeh, Jordan and Tell Beth-Shemesh, Israel. *Metals and mines: studies in archaeometallurgy* 2007;:189–201.<http://www.ironsmelting.net/www/smelting/index.html>

189

Waldbaum J. The coming of iron in the eastern Mediterranean. *The archaeometallurgy of the Asian old world* 1999;**University Museum symposium series**:27–57.

190

Muhly, James David, Wertime, Theodore A. *The coming of the age of iron*. New Haven: : Yale University Press 1980.

191

Young T. Some preliminary observations on hammerscale and its implications for understanding welding. *Historical metallurgy: journal of the Historical Metallurgy Society* 2011;**45**:26–41.

192

Young T, Poyner D. Two medieval bloomery smelting sites in Shropshire: the adoption of water power for iron smelting. *Historical metallurgy: journal of the Historical Metallurgy Society* 2012;**46**:78–97.

193

Belford D. Hot blast iron smelting in the early 19th century: a re-appraisal. *Historical metallurgy: journal of the Historical Metallurgy Society* 2012;**46**:9–18.

194

Crossley D. The blast furnace at Rockley, South Yorkshire. *The Archaeological journal* 1995;**152**:381–421. doi:10.1080/00665983.1995.11021434

195

Dillmann P, perez A, Vega E, et al. Understanding the Walloon method of iron refining: archaeological and archaeometric experiments, phase 1. *Historical metallurgy: journal of the Historical Metallurgy Society* 2012;**46**:19–31.

196

Gelegdorj E, Chunag A, Gordon RB, et al. Transitions in cast iron technology of the nomads in Mongolia. *Journal of Archaeological Science* 2007;**34**:1187–96. doi:10.1016/j.jas.2006.10.007

197

Hayman, Richard. *Ironmaking: the history and archaeology of the iron industry*. Stroud: : Tempus 2005.

198

Starley D. Determining the Technological Origins of Iron and Steel. *Journal of Archaeological Science* 1999;**26**:1127–33. doi:10.1006/jasc.1999.0408

199

Wagner DB. Chinese blast furnaces from the 10th to the 14th century. *Historical metallurgy: journal of the Historical Metallurgy Society* 2003;**37**:25–37.

200

Wagner, D.B. *Science and Civilisation in China. Vol. 5: Chemistry and Chemical Technology. Part 11: Ferrous Metallurgy*. London: : Cambridge University Press 2008.

201

Bisson, Michael S., Vogel, Joseph O. Ancient African metallurgy: the socio-cultural context. Walnut Creek, Calif: : AltaMira 2000.

202

Ver un reduction des prejuges et la fonte des antagonismes: un bilan de l'expansion de la metallurgie du fer en Afrique sub-Saharienne. Journal of African archaeology 2012;**10**.

203

Craddock PT. New paradigms for old iron: thoughts on E. Zangato & A.F.C Holl's 'On the iron front'. Journal of African archaeology 2010;**8**:29–36.

204

Chirikure S. Indigenous mining and metallurgy in Africa. Cambridge: : Cambridge University Press 2010.

205

Chirikure S. Geochemistry of Ancient Metallurgy: Examples from Africa and Elsewhere. In: Treatise on Geochemistry. Elsevier 2014.
169–89.https://ucl.primo.exlibrisgroup.com/view/action/uresolver.do?operation=resolveService&package_service_id=14355564180004761&institutionId=4761&customerId=4760&VE=true

206

Shadreck Chirikure and Thilo Rehren. Ores, Furnaces, Slags, and Prehistoric Societies: Aspects of Iron Working in the Nyanga Agricultural Complex, AD 1300-1900. The African Archaeological Review 2004;**21**:135–52.<http://www.jstor.org/stable/25130799>

207

Chirikure Shadreck, Burrett Rob, Heimann RB. Beyond furnaces and slags: a review study of bellows and their role in indigenous African metallurgical processes. Azania: Archaeological Research in Africa 2009;**44**:195–215. doi:10.1080/00671990903047108

208

Humphris J, Martínón-Torres M, Rehren T, et al. Variability in single smelting episodes – a pilot study using iron slag from Uganda. *Journal of Archaeological Science* 2009;**36**:359–69. doi:10.1016/j.jas.2008.09.020

209

Humphris J, Carey C. New methods for investigating slag heaps: Integrating geoprospection, excavation and quantitative methods at Meroe, Sudan. *Journal of Archaeological Science* 2016;**70**:132–44. doi:10.1016/j.jas.2016.04.022

210

Iles L, Martínón-Torres M. Pastoralist iron production on the Laikipia Plateau, Kenya: wider implications for archaeometallurgical studies. *Journal of Archaeological Science* 2009;**36**:2314–26. doi:10.1016/j.jas.2009.06.023

211

Killick D. What do we know about African iron working? *Journal of African archaeology* 2004;**2**:97–112. <http://www.jstor.org/stable/43135336>

212

David Killick. Cairo to Cape: The Spread of Metallurgy Through Eastern and Southern Africa. *Journal of World Prehistory* 2009;**22**:399–414. <http://www.jstor.org/stable/25801281>

213

Killick D. Invention and Innovation in African Iron-smelting Technologies. *Cambridge Archaeological Journal* 2015;**25**:307–19. doi:10.1017/S0959774314001176

214

Killick D, Miller D. Smelting of magnetite and magnetite-ilmenite iron ores in the northern Lowveld, South Africa, ca. 1000 CE to ca. 1880 CE. *Journal of Archaeological Science* 2014;**43**:239–55. doi:10.1016/j.jas.2013.12.016

215

La Niece S, Hook DR, Craddock PT, et al. Metals and mines: studies in archaeometallurgy. London: : Archetype in association with the British Museum 2007.

216

MacDonald KC, Vernet R, Martínón-Torres M, et al. Dhar Néma: from early agriculture to metallurgy in southeastern Mauritania. *Azania: Archaeological Research in Africa* 2009;**44**:3–48. doi:10.1080/00671990902811330

217

Duncan E. Miller and Nikolaas J. Van Der Merwe. Early Metal Working in Sub-Saharan Africa: A Review of Recent Research. *The Journal of African History* 1994;**35**:1–36.<http://www.jstor.org/stable/182719>

218

Rehren T, Charlton M, Chirikure S, et al. Decisions set in slag: the human factor in African iron smelting. In: *Metals and mines: studies in archaeometallurgy*. London: : Archetype in association with the British Museum 2007. 211–8.<http://www.ironsmelting.net/www/smelting/index.html>

219

Schmidt, Peter R. Iron technology in East Africa: symbolism, science, and archaeology. Bloomington, IN: : Indiana University Press 1997.

220

Serneels V. The massive production of iron in the Sahelian belt: Archaeological investigations at Korsimoro (Sanmatenga – Burkina Faso). *Materials and Manufacturing Processes* 2017;**32**:900–8. doi:10.1080/10426914.2016.1244842

221

Woodhouse J. Iron in Africa: the metal from nowhere. In: Transformations in Africa: essays on Africa's later past. London: : Leicester University Press 1998.
160–85.<https://contentstore.cla.co.uk/secure/link?id=817f0495-3d0b-e811-80cd-005056af4099>

222

Zangato E. On the iron front: new evidence from North-Central Africa. *Journal of African Archaeology* 2010;**8**:7–23.

223

Thilo R. Metals: Chemical analysis. In: Encyclopedia of archaeology. [Amsterdam?]: : ScienceDirect 2008.
1614–20.<http://linkinghub.elsevier.com/retrieve/pii/B9780123739629001886>

224

Bottaini C, Vilaça R, Schiavon N, et al. New insights on Late Bronze Age Cu-metallurgy from Coles de Samuel hoard (Central Portugal): A combined multi-analytical approach. *Journal of Archaeological Science: Reports* 2016;**7**:344–57. doi:10.1016/j.jasrep.2016.05.009

225

Bray PJ, Pollard AM. A new interpretative approach to the chemistry of copper-alloy objects: Source, recycling and technology. *Antiquity* 2012;**86**:853–67.<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9423556&fulltextType=RA&fileId=S0003598X00047967>

226

Pollard AM, Bray P, Gosden C, et al. Characterising copper-based metals in Britain in the first millennium AD: a preliminary quantification of metal flow and recycling. *Antiquity* 2015;**89**:697–713. doi:10.15184/aqy.2015.20

227

Bayley, J., Butcher, S. Roman brooches in Britain: a technological and typological study based on the Richborough Collection. London: : Society of Antiquaries of London 2004.

228

Dungworth D. Roman Copper Alloys: Analysis of Artefacts from Northern Britain. *Journal of Archaeological Science* 1997;**24**:901–10. doi:10.1006/jasc.1996.0169

229

Dungworth D. Iron Age and Roman Copper Alloys from Northern Britain. Internet *Archaeology* 2 Published Online First: 1997.http://intarch.ac.uk/journal/issue2/dungworth_toc.html

230

Frame L. Metallurgical investigations at Godin Tepe, Iran, Part I: the metal finds. *Journal of Archaeological Science* 2010;**37**:1700–15. doi:10.1016/j.jas.2010.01.030

231

Jouttijärvi A. Roman alloying practice. *Materials and Manufacturing Processes* 2017;**32**:813–26. doi:10.1080/10426914.2017.1279325

232

Martinón-Torres M, Li XJ, Bevan A, et al. Forty Thousand Arms for a Single Emperor: From Chemical Data to the Labor Organization Behind the Bronze Arrows of the Terracotta Army. *Journal of Archaeological Method and Theory* Published Online First: 2012. doi:10.1007/s10816-012-9158-z

233

Murillo-Barroso M, Pryce TO, Bellina B, et al. Khao Sam Kaeo – an archaeometallurgical crossroads for trans-asiatic technological traditions. *Journal of Archaeological Science* 2010;**37**:1761–72. doi:10.1016/j.jas.2010.01.036

234

Pagès G, Dillmann P, Fluzin P, et al. A study of the Roman iron bars of

Saintes-Maries-de-la-Mer (Bouches-du-Rhône, France). A proposal for a comprehensive metallographic approach. *Journal of Archaeological Science* 2011;**38**:1234–52.
doi:10.1016/j.jas.2010.12.017

235

Scott, David A. *Metallography and microstructure of ancient and historic metals*. [Marina del Rey, CA]: : Getty Conservation Institute 1991.
http://www.getty.edu/conservation/publications_resources/pdf_publications/pdf/metallography.pdf

236

Bayley J. *Medieval precious metal refining: archaeology and contemporary texts compared*. In: *Archaeology, history and science: integrating approaches to ancient materials*. Walnut Creek, CA: : Left Coast Press 2008.
131–50.<http://www.UCL.eblib.com/patron/Read.aspx?p=677776&pg=1>

237

Cech B. A roman gold mining district in eastern Austria. *Historical metallurgy: journal of the Historical Metallurgy Society* 2012;**46**:66–77.

238

Hosler, Dorothy. *The sounds and colors of power: the sacred metallurgical technology of ancient West Mexico*. Cambridge, Mass: : MIT Press 1994.

239

Jansen M, Aulbach S, Hauptmann A, et al. Platinum group placer minerals in ancient gold artifacts – Geochemistry and osmium isotopes of inclusions in Early Bronze Age gold from Ur/Mesopotamia. *Journal of Archaeological Science* 2016;**68**:12–23.
doi:10.1016/j.jas.2016.02.004

240

La Niece S, Meeks N. *Diversity of Goldsmithing Traditions in the Americas and the Old World*. In: *Precolumbian gold: technology, style and iconography*. London: : British Museum

Press 2000.

220–39. <https://contentstore.cla.co.uk//secure/link?id=9f52d9dc-6336-e711-80c9-005056af4099>

241

Lechtman H. The Gilding of metals in pre-Columbian Peru. In: Application of science in examination of works of art: proceedings of the seminar September 7-16, 1965. [Boston, Mass.]: : [Museum of Fine Arts] 1973. 38–52.

242

Lechtman, Heather. Pre-Columbian Surface Metallurgy. Scientific American 1984;**250**:56–63. doi:10.1038/scientificamerican0684-56

243

Leusch V, Armbruster B, Pernicka E, et al. On the Invention of Gold Metallurgy: The Gold Objects from the Varna I Cemetery (Bulgaria) - Technological Consequence and Inventive Creativity. Cambridge Archaeological Journal 2015;**25**:353–76. doi:10.1017/S0959774314001140

244

Maldonado Blanca, Rehren Thilo. Early copper smelting at Itziparátzico, Mexico. Journal of Archaeological Science 2009;**36**:1998–2006. doi:10.1016/j.jas.2009.05.019

245

Martinon-Torres M, Rehren T. Trials and errors in search of mineral wealth: metallurgical experiments in early colonial Jamestown. Rittenhouse: journal of the American Scientific Instrument Enterprise 2007;**21**:82–97. <http://discovery.ucl.ac.uk/93675/>

246

Martinón-Torres M, Rojas RV, Cooper J, et al. Metals, microanalysis and meaning: a study of metal objects excavated from the indigenous cemetery of El Chorro de Maíta, Cuba. Journal of Archaeological Science 2007;**34**:194–204. doi:10.1016/j.jas.2006.04.013

247

Martinon-Torres M, Cooper J, Valcarcel Rojas R, et al. Diversifying the picture: indigenous responses to European arrival in Cuba. *Archaeology international* 2008;:37–40.

248

Martinón-Torres M, Valcárcel Rojas R, Sáenz Samper J, et al. Metallic encounters in Cuba: The technology, exchange and meaning of metals before and after Columbus. *Journal of Anthropological Archaeology* 2012;**31**:439–54. doi:10.1016/j.jaa.2012.03.006

249

Martinón-Torres M, Uribe-Villegas MA. The prehistoric individual, connoisseurship and archaeological science: The Muisca goldwork of Colombia. *Journal of Archaeological Science* 2015;**63**:136–55. doi:10.1016/j.jas.2015.08.014

250

McEwan, Colin, British Museum. *Precolumbian gold: technology, style and iconography*. London: : British Museum Press 2000.

251

Mitteldeutscher Archäologentag. *Metals of Power – Early gold and silver [Metalle der Macht: Frühes Gold und Silber]*. Halle (Saale): : Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte 2014.

252

Plaza MT, Martín-Torres M. Metallurgical traditions under Inka rule: a technological study of metals and technical ceramics from the Aconcagua Valley, Central Chile. *Journal of Archaeological Science* 2015;**54**:86–98. doi:10.1016/j.jas.2014.11.029

253

Ramage, Andrew, Cowell, M. R., Craddock, P. T. *King Croesus' gold: excavations at Sardis*

and the history of gold refining. London: : British Museum Press in association with Archaeological Exploration of Sardis, Harvard University Art Museums 2000.

254

Cardale de Schrimpff, Marianne, Bray, Warwick. Calima and Malagana: art and archaeology in southwestern Colombia. Bogotá: : Pro Calima Foundation 2005.

255

Thibodeau AM, Killick DJ, Ruiz J, et al. The strange case of the earliest silver extraction by European colonists in the New World. *Proceedings of the National Academy of Sciences* 2007;**104**:3663–6. doi:10.1073/pnas.0607297104

256

Martinon-Torres M, Uribe Villegas MA. Composition, colour and context in Muisca votive metalwork (Colombia, AD 600-1800). *Antiquity* 2012;**86**:772–91. <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9423537&fulltextType=RA&fileId=S0003598X00047918>

257

Boiurgarit D, Thomas N. From laboratory to field experiments: shared experience in brass cementation. *Historical metallurgy: journal of the Historical Metallurgy Society* 2011;**45**:8–16.

258

Craddock P, Zhou W. Traditional Zinc Production in Modern China: Survival and Evolution. In: *Mining and metal production through the ages*. London: : British Museum 2003. 267–92.

259

Craddock P, Eckstein K. Production of brass in Antiquity by direct reduction. In: *Mining and metal production through the ages*. London: : British Museum 2003. 230–216.

260

Craddock PT, British Museum. 2000 years of zinc and brass. Rev. ed. London: : British Museum 1998.

261

Dungworth D. Roman Copper Alloys: Analysis of Artefacts from Northern Britain. *Journal of Archaeological Science* 1997;**24**:901–10. doi:10.1006/jasc.1996.0169

262

Dungworth D. Iron Age and Roman Copper Alloys from Northern Britain. Internet Archaeology Published Online First: 1997. doi:10.11141/ia.2.2

263

Martinón-Torres M, Rehren T. Agricola and Zwickau: theory and practice of Renaissance brass production in SE Germany. *Historical metallurgy: journal of the Historical Metallurgy Society* 2002;**45**:95–111.

264

Ponting M. Keeping up with the Romans? Romanisation and Copper Alloys in First Revolt Palestine. *IAMS Newsletter* ;:3–6.http://www.ucl.ac.uk/iams/newsletter/accordion/journals/iams_22/iams_22_2002_ponting

265

Ponting MJ. Roman military copper-alloy artefacts from Israel: questions of organization and ethnicity. *Archaeometry* 2008;**44**:555–71. doi:10.1111/1475-4754.t01-1-00086

266

Rehren T. Small Size, Large Scale Roman Brass Production in Germania Inferior. *Journal of Archaeological Science* 1999;**26**:1083–7. doi:10.1006/jasc.1999.0402

267

Rehren T. The same... but different: A juxtaposition of Roman and Medieval brass making in Central Europe. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. 252–7. <https://contentstore.cla.co.uk/secure/link?id=cc2c1c27-8136-e711-80c9-005056af4099>

268

Rehren T, Martínón-Torres M. *Naturam ars imitata: European brassmaking between craft and science*. In: *Archaeology, history and science: integrating approaches to ancient materials*. Walnut Creek, CA: : Left Coast Press 2008. 167–88. <http://UCL.ebib.com/patron/FullRecord.aspx?p=677776>

269

Thornton CP, Ehlers C. Early brass in the ancient Near East. *IAMS Newsletter* 2003;:3–8. http://www.ucl.ac.uk/iams/newsletter/accordion/journals/iams_23/iams_23_2003_thornton_ehlers

270

Welter J-M. The zinc content of brass: a chronological indicator. *Techne: La Science au Service de L'Histoire de L'Art Et des Civilisations* 2003;**18**:27–36.

271

Zacharias S. Brass making in medieval western Europe. In: *All that glitters: readings in historical metallurgy*. Montréal: : Metallurgical Society of the Canadian Institute of Mining and Metallurgy 1989. 35–40.

272

Zhou W, Martinon-Torres M, Chen J, et al. Distilling zinc for the Ming Dynasty: the technology of large scale zinc production in Fengdu, southwest China. *Journal of Archaeological Science* 2012;**39**:908–21. doi:10.1016/j.jas.2011.10.021

273

La Niece S, Hook DR, Craddock PT, et al. Metals and mines: studies in archaeometallurgy. London: : Archetype in association with the British Museum 2007.

274

Bayley J. Innovation in later medieval urban metalworking. Historical metallurgy: journal of the Historical Metallurgy Society 1996;**30**:67–71.<https://contentstore.cla.co.uk//secure/link?id=fbb26fdc-4a36-e711-80c9-005056af4099>

275

Bayley J, White H. Evidence for workshop practices at the Tudor mint in the Tower of London. In: The Renaissance workshop. London: : Archetype Publications in association with the British Museum 2013. 138–43.

276

Hogarth D. Martin Frobisher's largest 'gold mine' in Baffin Island. Historical metallurgy: journal of the Historical Metallurgy Society 1999;**33**:85–92.

277

Martinon-Torres M. The tools of the chymist: archeological and scientific analyses of early modern laboratories. In: Chymists and chymistry: studies in the history of alchemy and early modern chemistry. Sagamore Beach, Mass: : Science History Publications/USA 2007. 149–63.

278

Martinón-Torres M. Some recent developments in the historiography of alchemy. Ambix 2011;**58**:215–37. doi:10.1179/174582311X13129418299063

279

Martinon-Torres M. Inside Solomon's House: An Archaeological Study of the Old Ashmolean Chymical Laboratory in Oxford. Ambix 2012;**59**:22–48. doi:10.1179/174582312X13296104891436

280

Martinon-Torres M, Rehren Th, Sigrid von Osten S von O. A 16th century lab in a 21st century lab: archaeometric study of the laboratory equipment from Oberstockstall (Kirchberg am Wagram, Austria). *Antiquity* 2003;**77**
[.http://antiquity.ac.uk/projgall/martinon/index.html](http://antiquity.ac.uk/projgall/martinon/index.html)

281

Martinon-Torres M, Rehren Th. Alchemy, chemistry and metallurgy in Renaissance Europe. A wider context for fire assay remains. *Historical metallurgy: journal of the Historical Metallurgy Society* 2005;**39**:14–31.

282

Martinon-Torres M, Rehren T. Post-Medieval crucible production and distribution: A study of materials and materialities. *Archaeometry* 2009;**51**:49–74.
doi:10.1111/j.1475-4754.2007.00380.x

283

Mongiatti A, Martinon-Torres M, Rehren Th. Testing ores for gold and silver in Renaissance Austria: new techniques, new discoveries. In: *Proceedings: ISA 2006 : 36th International Symposium on Archaeometry : 2-6 May 2006, Quebec City, Canada*. Québec : CELAT, Université Laval 2009. 444/37-444/46.

284

Rehren Th. Alchemy and fire assay - an analytical approach. *Historical metallurgy: journal of the Historical Metallurgy Society* 1996;**30**
:136–42.<https://contentstore.cla.co.uk//secure/link?id=fdb26fdc-4a36-e711-80c9-005056af4099>

285

Budd PD, Ottaway BS. The properties of arsenical copper alloys: implications for the development of Eneolithic metallurgy. In: *Archaeological sciences 1989: proceedings of a conference on the application of scientific techniques to archaeology, Bradford, September 1989*. Oxford : Oxbow 1991.

132–42.<https://contentstore.cla.co.uk//secure/link?id=9d472646-7736-e711-80c9-005056af4099>

286

J. A. Charles. Early Arsenical Bronzes-A Metallurgical View. *American Journal of Archaeology* 1967;**71**:21–6.<http://www.jstor.org/stable/501586>

287

Northover P. Properties and use of arsenic-copper alloys. *Archäometallurgie der alten Welt: Beiträge zum Internationalen Symposium 'Old World Archaeometallurgy'*, Heidelberg 1987 1989;**Der Anschnitt, Beiheft**:111–8.

288

Young SMM, O'Brien W. Arsenical copper in early Irish metallurgy. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. 33–42. doi:<https://doi.org/10.30861/9781841710082>

289

Bayley J. Innovation in later medieval urban metalworking. *Historical metallurgy: journal of the Historical Metallurgy Society* 1996;**30**:67–71.<https://contentstore.cla.co.uk//secure/link?id=fbb26fdc-4a36-e711-80c9-005056af4099>

290

Bourgarit D, Thomas N. Late medieval copper alloying practices: a view from a Parisian workshop of the 14th century AD. *Journal of Archaeological Science* 2012;**39**:3052–70. doi:10.1016/j.jas.2012.04.009

291

Brownsword R. Medieval metalwork: an analytical study of copper-alloy objects. *Historical metallurgy: journal of the Historical Metallurgy Society* 2004;**38**:84–105.

292

Dungworth D, Nicholas M. Caldarium? An antimony bronze used for medieval and post-medieval cast domestic vessels. *Historical metallurgy: journal of the Historical Metallurgy Society* 2004;**38**:24–34. <https://contentstore.cla.co.uk/secure/link?id=d060ccd0-7106-e811-80cd-005056af4099>

293

Rehren T. The same.... but different: A juxtaposition of Roman and Medieval brass making in Central Europe. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. 252–7. <https://contentstore.cla.co.uk/secure/link?id=cc2c1c27-8136-e711-80c9-005056af4099>

294

Budd et al P. The early development of metallurgy in the British Isles. *Antiquity* 1992;**66**:677–86. doi:10.1017/S0003598X00039375

295

Chernych EN. Some of the most important aspects and problems of early Metal Age studying. In: *Die Anfänge der Metallurgie in der alten Welt = The beginnings of metallurgy in the old world*. Rahden, Westf: : Verlag Marie Leidorf 2002. 25–31.

296

Craddock PT. Copper smelting in Bronze Age Britain: Problems and Possibilities. In: *Early mining in the British Isles: proceedings of the Early Mining Workshop at Plas Tan y Bwlch, Snowdonia National Park Study Centre, 17-19 November, 1989*. Tan y Bwlch, Gwynedd: : Plas Tan y Bwlch, Snowdonia National Park Study Centre 1990. 69–71.

297

O'Brien, William, Brindley, Anna L. *Ross Island: mining, metal and society in early Ireland*. Galway: : Dept. of Archaeology, National University of Ireland, Galway 2004.

298

Murillo-Barroso M, Pryce TO, Bellina B, et al. Khao Sam Kaeo – an archaeometallurgical crossroads for trans-asiatic technological traditions. *Journal of Archaeological Science* 2010;**37**:1761–72. doi:10.1016/j.jas.2010.01.036

299

Piggott VC, Ciarla R. On the origins of metallurgy in prehistoric Southeast Asia: the view from Thailand. In: *Metals and mines: studies in archaeometallurgy*. London: : Archetype in association with the British Museum 2007. 76–88. <https://contentstore.cla.co.uk//secure/link?id=b2d980d9-9136-e711-80c9-005056af4099>

300

Pryce TO, Piggott VC, Martín-Torres M, et al. Prehistoric copper production and technological reproduction in the Khao Wong Prachan Valley of Central Thailand. *Archaeological and Anthropological Sciences* 2010;**2**:237–64. doi:10.1007/s12520-010-0043-y

301

Joyce C. White and Elizabeth G. Hamilton. The Transmission of Early Bronze Technology to Thailand: New Perspectives. *Journal of World Prehistory* 2009;**22**:357–97. <http://www.jstor.org/stable/25801280>

302

Bareham T. Bronze casting experiments. *Historical metallurgy: journal of the Historical Metallurgy Society* 1994;**28**:112–6. <https://contentstore.cla.co.uk//secure/link?id=08725dcf-4a36-e711-80c9-005056af4099>

303

Crew P. The experimental production of prehistoric bar iron. *Historical metallurgy: journal of the Historical Metallurgy Society* 1991;**25**:21–36. <https://contentstore.cla.co.uk//secure/link?id=b298f2d5-4a36-e711-80c9-005056af4099>

304

Ottaway, Barbara S., Wang, Quanyu. Casting experiments and microstructure of archaeologically relevant bronzes. Oxford: : Archaeopress 2004.
doi:<https://doi.org/10.30861/9781841716763>

305

Pryce TO, Bassiakos Y, Catapotis M, et al. 'De Caerimoniae' Technological choices in copper-smelting furnace design at early Bronze Age Chrysokamino, Crete. *Archaeometry* 2007;**49**:543–57. doi:[10.1111/j.1475-4754.2007.00319.x](https://doi.org/10.1111/j.1475-4754.2007.00319.x)

306

Aldenderfer M, Craig NM, Speakman RJ, et al. From the Cover: Four-thousand-year-old gold artifacts from the Lake Titicaca basin, southern Peru. *Proceedings of the National Academy of Sciences* 2008;**105**:5002–5. doi:[10.1073/pnas.0710937105](https://doi.org/10.1073/pnas.0710937105)

307

Benson, Elizabeth P., Dumbarton Oaks. Pre-Columbian metallurgy of South America: a conference at Dumbarton Oaks, October 18th and 19th, 1975. Washington, D.C.: : Dumbarton Oaks Research Library and Collections, Trustees for Harvard University 1979.

308

Maldonado B, Rehren T, Howell P. Archaeological copper smelting at Itziparatzico, Michoacan, Mexico, in Vandiver. In: *Materials issues in art and archaeology VII: symposium held November 30-December 3, 2004, Boston, Massachusetts, U.S.A.* Warrendale, Pa: : Materials Research Society 2005. 231–40.

309

Martinon-Torres M, Valcarcel Rojas R, Rehren T. Metals, microanalysis and meaning: a study of metal objects excavated from the indigenous cemetery of El Chorro de Malta, Cuba. *Journal of archaeological science* 2007;**34**:194–204. doi:[10.1016/j.jas.2006.04.013](https://doi.org/10.1016/j.jas.2006.04.013)

310

Schultze CA, Stanish C, Scott DA, et al. Direct evidence of 1,900 years of indigenous silver production in the Lake Titicaca Basin of Southern Peru. *Proceedings of the National Academy of Sciences* 2009;**106**:17280–3. doi:10.1073/pnas.0907733106

311

Shimada I, Gordus A, Griffin JA, et al. Sican alloying, working and use of precious metals: an interdisciplinary perspective. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. doi:https://doi.org/10.30861/9781841710082

312

Garcia-Guinea J, Correcher V, Rojas RM, et al. Chemical tracers in archaeological and natural gold: Aliseda Tartessos treasure and new discovered nuggets (SW Spain). *Gold Bulletin* 2005;**38**:23–8. doi:10.1007/BF03215224

313

Guerra MF, Calligaro T. Gold and cultural heritage objects: a review of studies of provenance and manufacturing technologies. *Measurement science and technology* 1990;:1527–37. doi:10.1088/0957-0233/14/9/305

314

Guerra MF, Calligaro T, Perea A. The treasure of Guarrazar: Tracing the gold supplies in the Visigothic Iberian peninsula. *Archaeometry* 2007;**49**:53–74. doi:10.1111/j.1475-4754.2007.00287.x

315

Rehren T, Temme M. Pre-Columbian gold processing at Putushio, South Ecuador: the archaeometallurgical evidence. In: *Archaeometry of pre-Columbian sites and artifacts: proceedings of a symposium organized by the UCLA Institute of Archaeology and the Getty Conservation Institute, Los Angeles, California, March 23-27, 1992*. Marina Del Rey, CA: : Getty Conservation Institute 1994. 267–84.

316

et al G-M. Early copper and Brass in Senegal. In: Society, culture, and technology in Africa. Philadelphia, PA: : MASCA, University of Pennsylvania Museum of Archaeology and Anthropology 1994. 45–62.

317

Augustin F. C. Holl. Early West African Metallurgies: New Data and Old Orthodoxy. Journal of World Prehistory 2009;**22**:415–38.<http://www.jstor.org/stable/25801282>

318

Miller DE, Van Der Merwe NJ. Early Metal Working in Sub-Saharan Africa: A Review of Recent Research. The Journal of African History 1994;**35**.
[doi:10.1017/S0021853700025949](https://doi.org/10.1017/S0021853700025949)

319

Begemann F. Tracing tin via isotope analyses. In: The beginnings of metallurgy: proceedings of the International Conference 'The Beginnings of Metallurgy', Bochum 1995. Bochum: : Deutsches Bergbau-Museum 1999. 277–84.

320

Giumlia-Mair, Alessandra R., Lo Schiavo, Fulvia, International Congress of Prehistoric and Protohistoric Sciences. Le problème de l'étain à l'origine de la métallurgie: The problem of early tin. Oxford: : Archaeopress 2003. [doi:https://doi.org/10.30861/9781841715643](https://doi.org/10.30861/9781841715643)

321

Haustein M, Gillis C, Pernicka E. Tin isotopy: A new method for solving old questions. Archaeometry 2010;**52**:816–32. [doi:10.1111/j.1475-4754.2010.00515.x](https://doi.org/10.1111/j.1475-4754.2010.00515.x)

322

Yener, K. Aslihan. The domestication of metals: the rise of complex metal industries in Anatolia. Leiden: : Brill 2000.

323

Barnard, Noel, Bulbeck, David. Ancient Chinese and Southeast Asian bronze age cultures: the proceedings of a conference held at the Edith and Joy London Foundation property, Kioloa, NSW, 8-12 February, 1988 /: conference papers. Taipei: : SMC 1996.

324

Chen K, Rehren T, Mei J, et al. Special alloys from remote frontiers of the Shang Kingdom: scientific study of the Hanzhong bronzes from southwest Shaanxi, China. Journal of Archaeological Science 2009;**36**:2108–18. doi:10.1016/j.jas.2009.04.016

325

Kunlong Chen. Indigenous production and interregional exchange: late second-millennium BC bronzes from the Hanzhong basin, China. Antiquity;**90**:665–78.
doi:<http://dx.doi.org/10.2307/3250165><http://dx.doi.org/10.1016/j.jas.2009.04.016><http://dx.doi.org/10.1016/j.jas.2009.04.017>

326

Chen K, Liu S, Li Y, et al. Evidence of arsenical copper smelting in Bronze Age China: A study of metallurgical slag from the Laoniupo site, central Shaanxi. Journal of Archaeological Science 2017;**82**:31–9. doi:10.1016/j.jas.2017.04.006

327

Liu S, Wang K, Cai Q, et al. Microscopic study of Chinese bronze casting moulds from the Eastern Zhou period. Journal of Archaeological Science 2013;**40**:2402–14.
doi:10.1016/j.jas.2012.11.010

328

Mei, Jianjun. Copper and bronze metallurgy in late prehistoric Xinjiang: its cultural context and relationship with neighbouring regions. Oxford: : Archaeopress 2000.
doi:<https://doi.org/10.30861/9781841710686>

329

Mei J, Chen K, Cao W. Scientific examination of Shang-dynasty bronzes from Hanzhong, Shaanxi Province, China. *Journal of Archaeological Science* 2009;**36**:1881–91. doi:10.1016/j.jas.2009.04.017

330

Mei J, Wang P, Chen K, et al. Archaeometallurgical studies in China: some recent developments and challenging issues. *Journal of Archaeological Science* 2015;**56**:221–32. doi:10.1016/j.jas.2015.02.026

331

Bagley, Robert W., Fong, Wen, So, Jenny F., et al. The great bronze age of China: an exhibition from the People's Republic of China. New York: : Metropolitan Museum of Art 1980.

332

Zhou W, Dong Y, Wan Q, et al. New research on lost-wax casting in ancient China. In: *Metallurgy and civilisation: Eurasia and beyond : proceedings of the 6th International Conference on the Beginnings of the Use of Metals and Alloys (BUMA VI)*. London: : Archetype 2009. 73–8.

333

Alipour R, Rehren T. Persian Pulād Production: Chāhak Tradition. *Journal of Islamic Archaeology* 2014;**1**:231–61. doi:10.1558/jia.v1i2.24174

334

Allan, James W., Gilmour, Brian J. J., University of Oxford, et al. Persian steel: the Tanavoli collection. Oxford: : Oxford University Press for the Board of the Faculty of Oriental Studies, University of Oxford and the British Institute of Persian Studies 2000.

335

Feuerbach A, Merkel j, Griffiths D. An examination of crucible steel in the manufacture of Damascus steel, including evidence from Merv, Turkmenistan. In: *Metallurgica Antiqua: in honour of Hans-Gert Bachmann and Robert Maddin*. Bochum: : Deutsches

Bergbau-Museum 1998. 37-44.

336

Papakhristu OA, Rehren T. Techniques and technology of ceramic vessel manufacture: crucibles for wootz smelting in Central Asia. In: *Modern trends in scientific studies on ancient ceramics: papers presented at the 5th European Meeting on Ancient Ceramics, Athens 1999*. Oxford: : Archaeopress 2002. 69-74.
doi:<https://doi.org/10.30861/9781841712895>

337

Rehren T, Papakhristu O. Cutting Edge Technology - The Ferghana process of medieval crucible steel making. *Metalla: Forschungsberichte des Deutschen Bergbau-Museums* 1994;:55-79.

338

Blakelock E, Martínón-Torres M, Veldhuijzen HA, et al. Slag inclusions in iron objects and the quest for provenance: an experiment and a case study. *Journal of Archaeological Science* 2009;**36**:1745-57. doi:[10.1016/j.jas.2009.03.032](https://doi.org/10.1016/j.jas.2009.03.032)

339

Coustures MP, Beziat D, Tollon F, et al. The use of trace element analysis of entrapped slag inclusions to establish ore - Bare iron links: Examples from two Gallo-Roman iron-making sites in France (Les Martys, Montagne Noire, and Les Ferrys, Loiret). *Archaeometry* 2003; **45**:599-613. doi:[10.1046/j.1475-4754.2003.00131.x](https://doi.org/10.1046/j.1475-4754.2003.00131.x)

340

Desaulty A-M, Dillmann P, L'Héritiera M, et al. Does it come from the Pays de Bray? Examination of an origin hypothesis for the ferrous reinforcements used in French medieval churches using major and trace element analyses. *Journal of Archaeological Science* 2009;**36**:2445-62. doi:[10.1016/j.jas.2009.07.002](https://doi.org/10.1016/j.jas.2009.07.002)

341

Host-Madsen L, Buchwald VF. The characterization and provenancing of ore, slag and iron

from the Iron Age settlements at Snorup. *Historical metallurgy: journal of the Historical Metallurgy Society*; **33**:57–67.

342

Schwab R, Heger D, Hoppner B, et al. The provenance of iron artefacts from Manching: A multi-technique approach. *Archaeometry* 2006;**48**:433–52.
doi:10.1111/j.1475-4754.2006.00265.x

343

Bray P, Cuenod A, Gosden C, et al. Form and flow: the 'karmic cycle' of copper. *Journal of Archaeological Science* 2015;**56**:202–9. doi:10.1016/j.jas.2014.12.013

344

Stos-Gale ZA, Gale NH. Metal provenancing using isotopes and the Oxford archaeological lead isotope database (OXALID). *Archaeological and Anthropological Sciences* 2009;**1**:195–213. doi:10.1007/s12520-009-0011-6

345

Pernicka E. Trace element fingerprinting of ancient copper: a guide to technology or provenance. In: *Metals in antiquity*. Oxford: : Archaeopress 1999. 163–71.
doi:https://doi.org/10.30861/9781841710082

346

Pollard AM, Bray PJ, Gosden C. Is there something missing in scientific provenance studies of prehistoric artefacts? *Antiquity* 2014;**88**:625–31. doi:10.1017/S0003598X00101255

347

Dungworth D. Serendipity in the foundry? Tin oxide inclusions in copper and copper alloys as an indicator of production process. *Bulletin of the metals museum* 2000;**32**:1–5.

348

Farci C, Martínón-Torres M, Álvarez DG. Bronze production in the Iron Age of the Iberian Peninsula: The case of El Castu , Vigaña (Asturias, NW Spain). *Journal of Archaeological Science: Reports* 2017;**11**:338–51. doi:10.1016/j.jasrep.2016.12.009

349

Rostoker W, McNallan M, Gebhard ER. Melting/smelting of bronze at Isthmia. *Historical metallurgy: journal of the Historical Metallurgy Society* 1983;**17**:23–6.

350

Rovira S. Bronze production in prehistory. 2005.
http://copernic.udg.es/arqueometria/PARTS/02_Proyecto2.pdf

351

Zhou W, Chen J, Lie X, et al. Three Western Zhou bronze foundry sites in the Zhouyuan are, Shaanxi province, China. In: *Metallurgy and civilisation: Eurasia and beyond : proceedings of the 6th International Conference on the Beginnings of the Use of Metals and Alloys (BUMA VI)*. London: : Archetype 2009. 62–72.

352

Stanley B. Alpern. Did They or Didn't They Invent It? Iron in Sub-Saharan Africa. *History in Africa* 2005;**32**:41–94.<http://www.jstor.org/stable/20065735>

353

Bisson, Michael S., Vogel, Joseph O. *Ancient African metallurgy: the socio-cultural context*. Walnut Creek, Calif: : AltaMira 2000.

354

Augustin F. C. Holl. Early West African Metallurgies: New Data and Old Orthodoxy. *Journal of World Prehistory* 2009;**22**:415–38.<http://www.jstor.org/stable/25801282>

355

Killick D. What do we know about African iron working? *Journal of African archaeology* 2004;**2**:97–112.<http://www.jstor.org/stable/43135336>

356

J. A. Charles. Early Arsenical Bronzes - A Metallurgical View. *American Journal of Archaeology* 1967;**71**:21–6.<http://www.jstor.org/stable/501586>

357

Bourgarit D, Thomas N. Late medieval copper alloying practices: a view from a Parisian workshop of the 14th century AD. *Journal of Archaeological Science* 2012;**39**:3052–70. doi:10.1016/j.jas.2012.04.009

358

Pryce TO, Bassiakos Y, Catapotis M, et al. 'De Caerimoniae' Technological choices in copper-smelting furnace design at early Bronze Age Chrysokamino, Crete. *Archaeometry* 2007;**49**:543–57. doi:10.1111/j.1475-4754.2007.00319.x

359

Rehren T, Temme M. Pre-Columbian gold processing at Putushio, South Ecuador: the archaeometallurgical evidence. In: *Archaeometry of pre-Columbian sites and artifacts: proceedings of a symposium organized by the UCLA Institute of Archaeology and the Getty Conservation Institute, Los Angeles, California, March 23-27, 1992*. Marina Del Rey, CA: : Getty Conservation Institute 1994. 267–84.

360

Hein A, Kilikoglou V, Kassianidou V. Chemical and mineralogical examination of metallurgical ceramics from a Late Bronze Age copper smelting site in Cyprus. *Journal of Archaeological Science* 2007;**34**:141–54. doi:10.1016/j.jas.2006.04.005

361

Mei, Jianjun. *Copper and bronze metallurgy in late prehistoric Xinjiang: its cultural context and relationship with neighbouring regions*. Oxford: : Archaeopress 2000. doi:<https://doi.org/10.30861/9781841710686>

362

Feuerbach A, Merkel J, Griffiths D. An examination of crucible steel in the manufacture of Damascus steel, including evidence from Merv, Turkmenistan. In: *Metallurgica Antiqua: in honour of Hans-Gert Bachmann and Robert Maddin*. Bochum: : Deutsches Bergbau-Museum 1998. 37–44.

363

Desaulty A-M, Dillmann P, L'Héritiera M, et al. Does it come from the Pays de Bray? Examination of an origin hypothesis for the ferrous reinforcements used in French medieval churches using major and trace element analyses. *Journal of Archaeological Science* 2009;**36**:2445–62. doi:10.1016/j.jas.2009.07.002