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Abe, Y. et al. (2009) 'On-site analysis of archaeological artifacts excavated from the site on the outcrop at Northwest Saqqara, Egypt, by using a newly developed portable fluorescence spectrometer and diffractometer', *Analytical and Bioanalytical Chemistry*, 395(7), pp. 1987–1996. Available at: <https://doi.org/10.1007/s00216-009-3141-x>.

Adriaens, A. (2005) 'Non-destructive analysis and testing of museum objects: An overview of 5 years of research', *Spectrochimica Acta Part B: Atomic Spectroscopy*, 60(12), pp. 1503–1516. Available at: <https://doi.org/10.1016/j.sab.2005.10.006>.

Alexander Bentley, R. (2006) 'Strontium Isotopes from the Earth to the Archaeological Skeleton: A Review', *Journal of Archaeological Method and Theory*, 13(3), pp. 135–187. Available at: <https://doi.org/10.1007/s10816-006-9009-x>.

'Archaeological and Anthropological Sciences.' (no date), 1(3). Available at: <http://link.springer.com/journal/12520/1/3/page/1>.

'Archaeometry' (no date a), 49(2). Available at: <http://onlinelibrary.wiley.com.libproxy.ucl.ac.uk/doi/10.1111/arch.2007.49.issue-2/issuetoc;jsessionid=C29BB0DA1059927413EA82D1C17CC253.d03t04>.

'Archaeometry' (no date b), 50(2). Available at: <http://onlinelibrary.wiley.com.libproxy.ucl.ac.uk/doi/10.1111/arch.2008.50.issue-6/issuetoc>.

'Archaeometry' (no date c), 50(6). Available at: <http://onlinelibrary.wiley.com.libproxy.ucl.ac.uk/doi/10.1111/arch.2008.50.issue-6/issuetoc>.

Arthur M. Sackler Colloquia of the National Academy of Sciences and National Academy of Sciences (U.S.) (2005) *Scientific examination of art: modern techniques in conservation and analysis*: National Academy of Sciences, Washington, D.C., March 19-21, 2003. Washington, D.C.: National Academies Press.

Artioli, G. and Angelini, I. (2010) *Scientific methods and cultural heritage: an introduction to the application of materials science to archaeometry and conservation science*. Oxford: Oxford University Press. Available at: <http://UCL.eblib.com/patron/FullRecord.aspx?p=618614>.

Baxter, M.J. (1994) *Exploratory multivariate analysis in archaeology*. Edinburgh: Edinburgh University Press. Available at: <https://www.jstor.org/stable/j.ctv2sx9gfb>.

Baxter, M.J. (2003) Statistics in archaeology. London: Arnold.

Baxter, M.J. and Buck, C.E. (2000) 'Data handling and statistical analysis', in Modern analytical methods in art and archaeology. New York: Wiley, pp. 681–746. Available at: <https://contentstore.cla.co.uk/secure/link?id=5381c5cf-6c15-e811-80cd-005056af4099>.

BAXTER, M.J. and FREESTONE, I.C. (2006) 'LOG-RATIO COMPOSITIONAL DATA ANALYSIS IN ARCHAEOOMETRY*', Archaeometry, 48(3), pp. 511–531. Available at: <https://doi.org/10.1111/j.1475-4754.2006.00270.x>.

Ben-David, M. and Flaherty, E.A. (2012) 'Stable isotopes in mammalian research: a beginner's guide', Journal of Mammalogy, 93(2), pp. 312–328. Available at: <https://doi.org/10.1644/11-MAMM-S-166.1>.

Bowman, S. (1991) Science and the past. London: British Museum Press.

Brothwell, D.R. and Pollard, A.M. (2001a) Handbook of archaeological sciences. Chichester: John Wiley.

Brothwell, D.R. and Pollard, A.M. (2001b) Handbook of archaeological sciences. Chichester: John Wiley.

Chaplin, T.D., Clark, R.J.H. and Martinón-Torres, M. (2010) 'A combined Raman microscopy, XRF and SEM-EDX study of three valuable objects - A large painted leather screen and two illuminated title pages in 17th century books of ordinances of the Worshipful Company of Barbers, London', Journal of Molecular Structure, 976(1-3), pp. 350–359. Available at: <https://doi.org/10.1016/j.molstruc.2010.03.042>.

Charalambous, A., Kassianidou, V. and Papasavvas, G. (2014) 'A compositional study of Cypriot bronzes dating to the Early Iron Age using portable X-ray fluorescence spectrometry (pXRF)', Journal of Archaeological Science, 46, pp. 205–216. Available at: <https://doi.org/10.1016/j.jas.2014.03.006>.

Charlton, M.F., Blakelock, E. and Martinon-Torres, M. (2012) 'Investigating the production provenance of iron artifacts with multivariate methods', Journal of Archaeological Science, 39(7), pp. 2280–2293. Available at: <http://discovery.ucl.ac.uk/1375923/1/1375923.pdf>.

Chippindale, C. (2006) 'Colleagues, talking, writing, publishing', in Handbook of archaeological methods. Lanham, Md: Altamira Press, pp. 1339–1371. Available at: <https://contentstore.cla.co.uk/secure/link?id=d9c1e291-e30c-e811-80cd-005056af4099>.

Ciliberto, E. and Spoto, G. (2000) Modern analytical methods in art and archaeology. New York: Wiley.

Colombo, C. et al. (2011) 'Non-invasive approach in the study of polychrome terracotta sculptures: employment of the portable XRF to investigate complex stratigraphy', X-Ray Spectrometry, 40(4), pp. 273–279. Available at: <https://doi.org/10.1002/xrs.1336>.

Contrey, R.M. et al. (2014) 'Calibration of a portable X-ray fluorescence spectrometer in the analysis of archaeological samples using influence coefficients', Geochemistry: Exploration, Environment, Analysis, 14(3). Available at:

[http://geea.lyellcollection.org.libproxy.ucl.ac.uk/content/14/3/291.full.pdf.](http://geea.lyellcollection.org.libproxy.ucl.ac.uk/content/14/3/291.full.pdf)

Cotte, M. et al. (2009) 'Recent applications and current trends in Cultural Heritage Science using synchrotron-based Fourier transform infrared micro-spectroscopy', *Comptes Rendus Physique*, 10(7), pp. 590–600. Available at: <https://doi.org/10.1016/j.crhy.2009.03.016>.

De Atley, S.P. and Bishop, R.L. (1991) 'Toward an integrated interface for archaeology and archaeometry', in *The ceramic legacy of Anna O. Shepard*. Niwot, Colo: University Press of Colorado, pp. 358–381. Available at:
<https://contentstore.cla.co.uk/secure/link?id=724ac537-6915-e811-80cd-005056af4099>.

De Benedetto, G.E. et al. (2002) 'Infrared spectroscopy in the mineralogical characterization of ancient pottery', *Journal of Cultural Heritage*, 3(3), pp. 177–186. Available at: [https://doi.org/10.1016/S1296-2074\(02\)01178-0](https://doi.org/10.1016/S1296-2074(02)01178-0).

Degryse, P. (2013) 'Isotope-Ratio Techniques in Glass Studies', in K. Janssens (ed.) *Modern Methods for Analysing Archaeological and Historical Glass*. Oxford, UK: John Wiley & Sons Ltd, pp. 235–245. Available at: <https://doi.org/10.1002/9781118314234.ch10>.

Degryse, P., Henderson, J. and Hodgins, G. (2009) *Isotopes in vitreous materials*. Leuven, Belgium: Leuven University Press. Available at: <https://www.jstor.org/stable/j.ctt9qdx40>.

Demortier, G. et al. (2000) Ion beam study of art and archaeological objects. Luxembourg: Office for Official Publications of the European Communities.

Derrick, M.R., Stulik, D.C. and Landry, J.M. (1999) *Infrared Spectroscopy in Conservation Science - infrared spectroscopy*. Los Angeles: Getty Conservation Institute. Available at: <http://www.getty.edu/publications/virtuallibrary/0892364696.html>.

Dran, J.-C. et al. (2004) 'Ion beam analysis of art works: 14 years of use in the Louvre', *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, 219–220, pp. 7–15. Available at:
<https://doi.org/10.1016/j.nimb.2004.01.019>.

Drennan, R.D. (2009) *Statistics for archaeologists: a commonsense approach*. 2nd ed. New York: Springer. Available at: <http://dx.doi.org/10.1007/978-1-4419-0413-3>.

Dungworth, D. and Girbal, B. (2011) 'Walmer Castle, Deal, Kent: Analysis of Window Glass', *English Heritage Research Department Report Series*, 2011(2). Available at:
<http://archaeologydataservice.ac.uk/archives/view/greylit/details.cfm?id=11363>.

Dussubieux, L. and Walder, H. (2015) 'Identifying American native and European smelted coppers with pXRF: a case study of artifacts from the Upper Great Lakes region', *Journal of Archaeological Science*, 59, pp. 169–178. Available at:
<https://doi.org/10.1016/j.jas.2015.04.011>.

Edwards, H.G.M., Chalmers, J.M., and Royal Society of Chemistry (Great Britain) (2005) *Raman spectroscopy in archaeology and art history*. Cambridge: Royal Society of Chemistry.

Eiland, M.L. and Williams, Q. (2001) 'Investigation of Islamic ceramics from Tell Tuneinir

using X-ray diffraction', *Geoarchaeology*, 16(8), pp. 875–903. Available at: <https://doi.org/10.1002/gea.1025>.

Eliyahu-Behar, A. et al. (2008) 'An integrated approach to reconstructing primary activities from pit deposits: iron smithing and other activities at Tel Dor under Neo-Assyrian domination', *Journal of Archaeological Science*, 35(11), pp. 2895–2908. Available at: <https://doi.org/10.1016/j.jas.2008.06.004>.

Fletcher, M. and Lock, G.R. (1991) *Digging numbers: elementary statistics for archaeologists*. Oxford: Oxford University Committee for Archaeology.

Forster, N. et al. (2011) 'Non-destructive analysis using PXRF: methodology and application to archaeological ceramics', *X-Ray Spectrometry*, 40(5), pp. 389–398. Available at: <https://doi.org/10.1002/xrs.1360>.

Frahm, Ellery (2013a) 'Is obsidian sourcing about geochemistry or archaeology? A reply to Speakman and Shackley', *Journal of Archaeological Science*, 40(2), pp. 1444–1448. Available at: <https://doi.org/10.1016/j.jas.2012.10.001>.

Frahm, E. (2013) 'Silo science and portable XRF in archaeology: a response to Speakman and Shackley', *Journal of Archaeological Science*, 40(2), pp. 1435–1443. Available at: <https://doi.org/10.1016/j.jas.2012.09.033>.

Frahm, Ellery (2013b) 'Validity of "off-the-shelf" handheld portable XRF for sourcing Near Eastern obsidian chip debris', *Journal of Archaeological Science*, 40(2), pp. 1080–1092. Available at: <https://doi.org/10.1016/j.jas.2012.06.038>.

Frahm, E. and Doonan, R.C.P. (2013) 'The technological versus methodological revolution of portable XRF in archaeology', *Journal of Archaeological Science*, 40(2), pp. 1425–1434. Available at: <https://doi.org/10.1016/j.jas.2012.10.013>.

Freestone, I.C. et al. (2003) 'Strontium Isotopes in the Investigation of Early Glass Production: Byzantine and Early Islamic Glass from the Near East*', *Archaeometry*, 45(1), pp. 19–32. Available at: <https://doi.org/10.1111/1475-4754.00094>.

Freestone, I.C. and Middleton, A.P. (1987) 'Mineralogical applications of the analytical SEM in archaeology', *Mineralogical Magazine*, 51, pp. 21–31. Available at: http://www.minersoc.org/pages/Archive-MM/Volume_51/51-359-21.pdf.

Gauss, R.K. et al. (2013) 'The Early Bronze Age settlement of Fidvár, Vráble (Slovakia): reconstructing prehistoric settlement patterns using portable XRF', *Journal of Archaeological Science*, 40(7), pp. 2942–2960. Available at: <https://doi.org/10.1016/j.jas.2013.01.029>.

Giumlia-Mair, A. et al. (2010) 'Surface characterisation techniques in the study and conservation of art and archaeological artefacts: a review', *Materials Technology*, 25(5), pp. 245–261. Available at: <https://doi.org/10.1179/175355510X12850784228001>.

Goffer, Z. (2007) *Archaeological chemistry*. 2nd ed. Hoboken, N.J.: Wiley.

Goren, Y., Mommsen, H. and Klinger, J. (2011) 'Non-destructive provenance study of

cuneiform tablets using portable X-ray fluorescence (pXRF)', *Journal of Archaeological Science*, 38(3), pp. 684–696. Available at: <https://doi.org/10.1016/j.jas.2010.10.020>.

Grave, P. et al. (2012) 'Non-destructive pXRF of mafic stone tools', *Journal of Archaeological Science*, 39(6), pp. 1674–1686. Available at: <https://doi.org/10.1016/j.jas.2011.11.011>.

Hamilton, E. (2004) 'The four scales of technical analysis; or 'how to make archaeometry more useful', in Exploring the role of analytical scale in archaeological interpretation. Oxford: Archaeopress, pp. 45–48. Available at: <https://contentstore.cla.co.uk/secure/link?id=1dfef87-db0c-e811-80cd-005056af4099>.

Hancock, R.G.V. (2000) 'Elemental analysis', in *Modern analytical methods in art and archaeology*. New York: Wiley, pp. 11–20.

HAUSTEIN, M., GILLIS, C. and PERNICKA, E. (2010) 'TIN ISOTOPY-A NEW METHOD FOR SOLVING OLD QUESTIONS', *Archaeometry*, 52(5), pp. 816–832. Available at: <https://doi.org/10.1111/j.1475-4754.2010.00515.x>.

Heginbotham, A. et al. (2010) 'An Evaluation of inter-laboratory reproducibility for quantitative XRF of historic copper Alloys', in P. Mardikian et al. (eds) In Metal 2010. Proceedings of the International Conference on Metal Conservation, Charleston, South Carolina, USA, October 11–15, 2010. Clemson University, pp. 178–188. Available at: http://www.getty.edu/museum/pdfs/heginbotham_metal2010_submitted2.pdf.

Hein, A. et al. (2002) 'Standardisation of elemental analytical techniques applied to provenance studies of archaeological ceramics: an inter laboratory calibration study', *The Analyst*, 127(4), pp. 542–553. Available at: <https://doi.org/10.1039/b109603f>.

Henderson, J. (1989) *Scientific analysis in archaeology and its interpretation*. Oxford: Oxford University Committee for Archaeology, Institute of Archaeology.

Henderson, J. (2000) *The science and archaeology of materials: an investigation of inorganic materials*. London: Routledge. Available at: <https://ebookcentral.proquest.com/lib/UCL/detail.action?docID=1144554&pq-origsite=primo>.

Hunt, A.M.W. and Speakman, R.J. (2015) 'Portable XRF analysis of archaeological sediments and ceramics', *Journal of Archaeological Science*, 53, pp. 626–638. Available at: <https://doi.org/10.1016/j.jas.2014.11.031>.

Ingo, G.M. et al. (2006) 'Combined use of SEM-EDS, OM and XRD for the characterization of corrosion products grown on silver roman coins', *Applied Physics A*, 83(4), pp. 493–497. Available at: <https://doi.org/10.1007/s00339-006-3533-0>.

Janssens, K.H.A. (2011) *Modern methods for analysing archaeological and historical glass*. Chichester, West Sussex, United Kingdom: John Wiley & Sons Inc. Available at: <http://dx.doi.org/10.1002/9781118314234>.

Janssens, K.H.A. and Grieken, R. van (2004) *Non-destructive microanalysis of cultural heritage materials*. Amsterdam, London: Elsevier.

Jones, A. (2001) Archaeological theory and scientific practice. Cambridge: Cambridge University Press. Available at: <https://doi.org/https://doi.org/10.1017/CBO9780511606069>.

Jones, A. (2004) 'Archaeometry and materiality: materials-based analysis in theory and practice*', *Archaeometry*, 46(3), pp. 327–338. Available at: <https://doi.org/10.1111/j.1475-4754.2004.00161.x>.

Kearns, T., Martinón-Torres, M. and Rehren, T. (2010) 'Metal to mould: alloy identification in experimental casting moulds using XRF', *Historical metallurgy: journal of the Historical Metallurgy Society*, 44(1), pp. 48–58.

Killick, D. (1997) 'Archaeology and archaeometry: From casual dating to a meaningful relationship?', *Antiquity*, 71(273), pp. 518–524. Available at: <http://search.proquest.com/docview/217552149?accountid=14511>.

Killick, D. (2015) 'The awkward adolescence of archaeological science', *Journal of Archaeological Science*, 56, pp. 242–247. Available at: <https://doi.org/10.1016/j.jas.2015.01.010>.

Kovacs, R. et al. (2009) 'Characterization of calibration materials for trace element analysis and fingerprint studies of gold using LA-ICP-MS', *Journal of Analytical Atomic Spectrometry*, 24(4). Available at: <https://doi.org/10.1039/b819685k>.

Lambert, J.B. (1997) Traces of the past: unraveling the secrets of archaeology through chemistry. Reading, Mass: Addison-Wesley.

LEE-THORP, J.A. (2008) 'ON ISOTOPES AND OLD BONES*', *Archaeometry*, 50(6), pp. 925–950. Available at: <https://doi.org/10.1111/j.1475-4754.2008.00441.x>.

Liu, S. et al. (2012) 'Silk Road glass in Xinjiang, China: chemical compositional analysis and interpretation using a high-resolution portable XRF spectrometer', *Journal of Archaeological Science*, 39(7), pp. 2128–2142. Available at: <https://doi.org/10.1016/j.jas.2012.02.035>.

Martini, M. et al. (2004) Physics methods in archaeometry. Amsterdam: IOS Press.

Martinón-Torres, M. (2008) 'Why should archaeologists take history and science seriously?', in Archaeology, history and science: integrating approaches to ancient materials. Walnut Creek, CA: Left Coast Press, pp. 15–36. Available at: http://ls-tlss.ucl.ac.uk/course-materials/ARCLG107_45457.pdf.

Martinón-Torres, M. et al. (2012) 'Metallic encounters in Cuba: The technology, exchange and meaning of metals before and after Columbus', *Journal of Anthropological Archaeology*, 31(4), pp. 439–454. Available at: <https://doi.org/10.1016/j.jaa.2012.03.006>.

Martinón-Torres, M. et al. (2014) '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*, 21(3), pp. 534–562. Available at: <https://doi.org/10.1007/s10816-012-9158-z>.

Martinón-Torres, M. and Killic, D.C. (2015) 'Archaeological Theories and Archaeological

Sciences', in A. Gardner, M. Lake, and U. Sommer (eds) *The Oxford Handbook of Archaeological Theory*. Available at:
<http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199567942.001.0001/oxfordhb-9780199567942-e-004?rskey=F3hTAd&result=1>.

Martinón-Torres, M. and Rehren, T. (2008) Archaeology, history and science: integrating approaches to ancient materials. Walnut Creek, CA: Left Coast Press.

Martinón-Torres, M. and Uribe-Villegas, M.A. (2015a) 'The prehistoric individual, connoisseurship and archaeological science: The Muisca goldwork of Colombia', *Journal of Archaeological Science*, 63, pp. 136–155. Available at:
<https://doi.org/10.1016/j.jas.2015.08.014>.

Martinón-Torres, M. and Uribe-Villegas, M.A. (2015b) 'The prehistoric individual, connoisseurship and archaeological science: The Muisca goldwork of Colombia', *Journal of Archaeological Science*, 63, pp. 136–155. Available at:
<https://doi.org/10.1016/j.jas.2015.08.014>.

Milić, M. (2014) 'PXRF characterisation of obsidian from central Anatolia, the Aegean and central Europe', *Journal of Archaeological Science*, 41, pp. 285–296. Available at:
<https://doi.org/10.1016/j.jas.2013.08.002>.

Moreau, J.-F. (2009) Proceedings: ISA 2006 : 36th International Symposium on Archaeometry : 2-6 May 2006, Quebec City, Canada. Québec: CELAT, Université Laval.

Nazaroff, A.J., Prufer, K.M. and Drake, B.L. (2010) 'Assessing the applicability of portable X-ray fluorescence spectrometry for obsidian provenance research in the Maya lowlands', *Journal of Archaeological Science*, 37(4), pp. 885–895. Available at:
<https://doi.org/10.1016/j.jas.2009.11.019>.

Nesse, W.D. (2004) *Introduction to optical mineralogy*. 3rd ed. New York: Oxford University Press.

Nicholas, M. and Manti, P. (15AD) 'Testing the applicability of handheld portable XRF to the characterisation of archaeological copper alloys', in J. Bridgland (ed.) ICOM-CC 17th Triennial Conference Preprints, Melbourne. Paris: International Council of Museums. Available at: <http://orca.cf.ac.uk/65469/>.

Ogburn, D., Sillar, B. and Sierra, J.C. (2013) 'Evaluating effects of chemical weathering and surface contamination on the in situ provenance analysis of building stones in the Cuzco region of Peru with portable XRF', *Journal of Archaeological Science*, 40(4), pp. 1823–1837. Available at: <https://doi.org/10.1016/j.jas.2012.09.023>.

Olsen, S.L. (1988) *Scanning electron microscopy in archaeology*. Oxford: B.A.R. Available at: <https://doi.org/https://doi.org/10.30861/9780860545798>.

Orfanou, V. and Rehren, Th. (2015) 'A (not so) dangerous method: pXRF vs. EPMA-WDS analyses of copper-based artefacts', *Archaeological and Anthropological Sciences*, 7(3), pp. 387–397. Available at: <https://doi.org/10.1007/s12520-014-0198-z>.

Orton, C. (2000) *Sampling in archaeology*. Cambridge: Cambridge University Press.

Available at: <https://doi.org/10.1017/CBO9781139163996>.

Orton, Clive (1980) Mathematics in archaeology. London: Collins.

Parkes, P.A. (1986) Current scientific techniques in archaeology. London: Croom Helm.

Pérez-Arantegui, J. (ed.) (2006) Proceedings of the 34th International Symposium on Archaeometry. Available at: <http://ifc.dpz.es/publicaciones/ebooks/id/2610>.

Pollard, A.M. et al. (2007) Analytical chemistry in archaeology. Cambridge: Cambridge University Press.

Pollard, A.M. et al. (2017) Archaeological chemistry. Cambridge: Royal Society of Chemistry.

Potts, P.J., Williams-Thorpe, O. and Webb, P.C. (1997) 'The Bulk Analysis of Silicate Rocks by Portable X-Ray Fluorescence: Effect of Sample Mineralogy in Relation to the Size of the Excited Volume', *Geostandards and Geoanalytical Research*, 21(1), pp. 29–41. Available at: <https://doi.org/10.1111/j.1751-908X.1997.tb00529.x>.

Rehren, T. (2001) 'Qantir-Piramesses and the organisation of the Egyptian glass industry', in *The social context of technological change: Egypt and the Near East, 1650-1550 B.C.* : proceedings of a conference held at St Edmund Hall, Oxford, 12-14 September 2000. Oxford: Oxbow, pp. 223–138. Available at: <https://contentstore.cla.co.uk/secure/link?id=eadf6446-d60c-e811-80cd-005056af4099>.

Ricciardi, P. et al. (2009) 'A non-invasive study of Roman Age mosaic glass tesserae by means of Raman spectroscopy', *Journal of Archaeological Science*, 36(11), pp. 2551–2559. Available at: <https://doi.org/10.1016/j.jas.2009.07.008>.

Sand-Jensen, K. (2007) 'How to write consistently boring scientific literature', *Oikos*, 116(5), pp. 723–727. Available at: <https://doi.org/10.1111/j.0030-1299.2007.15674.x>.

Sax, M. et al. (2008) 'The origins of two purportedly pre-Columbian Mexican crystal skulls', *Journal of Archaeological Science*, 35(10), pp. 2751–2760. Available at: <https://doi.org/10.1016/j.jas.2008.05.007>.

Scott, R.B. et al. (2015) 'A methodology for qualitative archaeometallurgical fieldwork using a handheld X-ray fluorescence spectrometer', *STAR: Science & Technology of Archaeological Research*, 1(2), pp. 70–80. Available at: <https://doi.org/10.1080/20548923.2016.1183941>.

Scott, R.B., Eekelers, K. and Degryse, P. (2016) 'Quantitative Chemical Analysis of Archaeological Slag Material Using Handheld X-ray Fluorescence Spectrometry', *Applied Spectroscopy*, 70(1), pp. 94–109. Available at: <https://doi.org/10.1177/0003702815616741>.

Shackley, M. (2010) 'Is there reliability and validity in portable X-ray fluorescence spectrometry (XRF)?', *SAA archaeological record*, pp. 17–20.

Shackley, M. (2011a) 'An introduction to X-Ray Fluorescence (XRF) analysis in

archaeology', in X-ray fluorescence spectrometry (XRF) in geoarchaeology. New York: Springer, pp. 7-44. Available at: https://doi.org/10.1007/978-1-4419-6886-9_2.

Shackley, M. (2011b) 'An introduction to X-Ray Fluorescence (XRF) analysis in archaeology', in X-ray fluorescence spectrometry (XRF) in geoarchaeology. New York: Springer, pp. 7-44. Available at: https://doi.org/10.1007/978-1-4419-6886-9_2.

Shackley, M.S. (2011) 'An Introduction to X-Ray Fluorescence (XRF) Analysis in Archaeology', in M.S. Shackley (ed.) X-Ray Fluorescence Spectrometry (XRF) in Geoarchaeology. New York, NY: Springer New York, pp. 7-44. Available at: https://doi.org/10.1007/978-1-4419-6886-9_2.

Shackley, M.S. (2012) 'Portable X-ray Fluorescence Spectrometry (pXRF): The Good, the Bad, and the Ugly', *Archaeology Southwest Magazine*, 26(2). Available at: http://www.archaeologysouthwest.org/pdf/pXRF_essay_shackley.pdf.

Shennan, S. (1997) Quantifying archaeology. 2nd ed. Iowa City: University of Iowa Press. Available at: <https://www.jstor.org/stable/10.3366/j.ctvxcrtz3>.

Shugar, A.N. (2013) 'Portable X-ray Fluorescence and Archaeology: Limitations of the Instrument and Suggested Methods To Achieve Desired Results', in R.A. Armitage and J.H. Burton (eds) Archaeological chemistry VIII. Washington, DC: American Chemical Society, pp. 173-189.

Shugar, A.N. and Mass, J.L. (2012) Handheld XRF for art and archaeology. Leuven: Leuven University Press. Available at: <https://www.jstor.org/stable/j.ctt9qdzfs>.

Sillar, B. and Tite, M.S. (2000) 'The challenge of "Technological choices" for materials science approaches in archaeology', *Archaeometry*, 42(1), pp. 2-20. Available at: <https://doi.org/10.1111/j.1475-4754.2000.tb00863.x>.

Speakman, R.J. et al. (2011) 'Sourcing ceramics with portable XRF spectrometers? A comparison with INAA using Mimbres pottery from the American Southwest', *Journal of Archaeological Science*, 38(12), pp. 3483-3496. Available at: <https://doi.org/10.1016/j.jas.2011.08.011>.

Tite, M.S. (2001) 'Overview - materials study in archaeology', in *Handbook of archaeological sciences*. Chichester: John Wiley, pp. 443-448. Available at: <https://contentstore.cla.co.uk/secure/link?id=db56c214-7a15-e811-80cd-005056af4099>.

Tite, M.S. (2002) 'Archaeological Collections: Invasive Sampling versus Object Integrity', *Papers from the Institute of Archaeology*, 13. Available at: <https://doi.org/10.5334/pia.189>.

Torrence, R., Rehren, T. and Martinon-Torres, M. (2015) 'Scoping the Future of Archaeological Science: Papers in Honour of Richard Klein', *Journal of Archaeological Science*, 56. Available at: <http://www.sciencedirect.com/science/journal/03054403/56>.

Tubb, K.W. (2007) 'Irreconcilable Differences? Problems with Unprovenanced Antiquities', *Papers from the Institute of Archaeology*, 18. Available at: <https://doi.org/10.5334/pia.294>.

Tykot, R.H. (2016) 'Using Nondestructive Portable X-ray Fluorescence Spectrometers on Stone, Ceramics, Metals, and Other Materials in Museums: Advantages and Limitations', *Applied Spectroscopy*, 70(1), pp. 42–56. Available at:
<https://doi.org/10.1177/0003702815616745>.

Uda, M. et al. (2005) *X-rays for archaeology*. Dordrecht: Springer. Available at:
<https://link.springer.com/book/10.1007/1-4020-3581-0>.

White, P. (2006) 'Producing the record', in *Archaeology in practice: a student guide to archaeological analyses*. Malden, MA: Blackwell, pp. 410–425. Available at:
<https://contentstore.cla.co.uk/secure/link?id=0e7f700a-df0c-e811-80cd-005056af4099>.

Young, M.L. et al. (2010) 'Non-invasive characterization of manufacturing techniques and corrosion of ancient Chinese bronzes and a later replica using synchrotron X-ray diffraction', *Applied Physics A*, 100(3), pp. 635–646. Available at:
<https://doi.org/10.1007/s00339-010-5646-8>.