

INDEX

for serial founder effect (in human AAS. See atomic absorption spectroscopy Abu Hureyra site, 223-224 evolution), 20-21 accelerator mass spectroscopy (AMS), 409 for woolly mammoth genomes, 25-26 aDNA. See ancient DNA contamination of, 16 alleles, 26 in laboratories, 17 allometry, in GMM techniques, 207 definition of, 13-14 amino acids, 35-37 degradation of, 15-17 asparagine, 39 demographic inference from, 24-26 chirality of, 37 coalescent theory and, 24-25 complex structure of, 37 coalescent-based approaches, 25 glutamine, 39 with nuclear genetic markers, 24 phylogeographic inference, 24 peptide, 35, 38 in Denisovan hominins, 23 racemisation, 37, 246-247 AMS. See accelerator mass spectroscopy High Throughput Sequencing of, 17-19 Anatomically Modern Humans, 416-417 in humans, 23 ancient DNA (aDNA) from mitochondria analyses of, 20-23 in case studies, 19-20 with genomic data, 22 data analysis of, 22 with mitochondrial data, 22 inheritance mechanisms, 22-23 modern DNA analyses compared to, in Neanderthals, 23 Next Generation Sequencing of, 17-19 multiregional (MRE) hypotheses, 21 See also High Throughput recent African origins (RAO) Sequencing hypothesis, 21 reconstruction of genomes in, 18 serial founder effect and, 20-21 Sanger sequencing compared to, 18 capture data for, 19 from nuclear genomes case studies data analysis of, 22 recombination processes, 22 for incomplete lineage sorting and human evolution, 23 preservation of, 15-16 for mitochondrial capture at Sima de purpose and function of, 13-14 los Huesos, 19-20 for establishing of biological sex, 13-14



ancient DNA (aDNA) (cont.)	multi-faceted approach, scope of, 3
reconstruction of past diets, 13-14	New Archaeology and, 5
for species identification, 13-14	stratigraphy as framework of, 5
retrieval of, challenges for, 14–16	technologies and techniques in, 4
degradation issues, 15–16	archaeomalacology, 242
environmental factors for, 15	archaeometallurgy, 377–381
hydrolysis of DNA, 15	analytical practice of, 378-379
Sanger sequencing for, 17–19	artefact reconstruction, 380
NGS compared to, 18	composition identification, 379
PCR method in, 17	compositional groups, of metals, 380
at Sima de los Huesos site, 19–20	data interpretation through, 381
source materials for, 14-15	provenancing in, 380-381
whole genome sequences in, 19	theoretical approach to, 381-382
baits in, 19	Archaeometry (journal), 6
ancient proteins	artefacts. See also ceramics; glass; lithic
recovery of, 36-37	analysis
survival of, 39-40	animal bones as, 225
animals. See also invertebrate	reconstruction of, through
zooarchaeology; vertebrate	achaeometallurgy, 380
zooarchaeology	residue analysis from, 71-75
bioapatites in, oxygen isotopes and,	formation of, 71
107–109	in visible deposits, 80-81
diet studies for	shells as, 257-260
with carbon isotopes, 132-133	ascertainment bias, 26-27
with nitrogen isotopes, 135–136	asparagine, 39
extinct	atomic absorption spectroscopy (AAS), 393
genomes of, 25-26	
proteins of, 39-40	baits, in whole genome sequences, 19
in human dietary studies, as baselines,	baselines, in human dietary isotope studies,
135–136	135–136
movement of, 100	bioapatites
reconstruction of, from bones, 221-222	diagenesis of, 103-104
strontium in, 103	isotope analysis of, 100
anthracology, 276-277	carbonate components, 109-110
anthropogenesis, in palaeoethnobotany, 277	oxygen, 109
apical root translucency method, 154	phosphate components, 109
archaeobotany, 276. See also	strontium, 103–105
palaeoethnobotany	bioavailability
archaeological science	chemical weathering and, 101–102
dataset integration in, 7	estimation of, 101–103
definition of, 3-4	mixing in, 102
future of, 6–8	outputs in, 102
history of, 5-6	in strontium studies, 101–103
mainstream sciences and, 5-6	bone collagen, isotope analysis for, 130–138



carbon isotopes, 130–133	for marine resource use, 86-87
with EDTA, 127	methodological techniques for, 342-343
extraction methods, 126–127	with hand lens, 338-340
with HCI acid, 127	with polarising light microscopy
for measurements of, 126-127	(PLM), 340-341
nitrogen isotopes, 128–129	with scanning electron microscopy
quality control methods, 126–127	(SEM), 341
bones	pottery vessels, proteomics for, 56
diagenesis, 103-104	production technology for, 336-342
proteomes, 57	source materials as influence on,
in vertebrate zooarchaeology, 219–222	337-338
as data source, 222–227	purpose and function of, 337
identification protocols, 219-220	source materials, 336
preservation protocols, 218	production based on, 337-338
quantification and calculation	unusual, 343–344
protocols, 220–221	as wares, 340
reconstruction of living animals from,	ceremonies, ritual uses of plants in, 295-296
221–222	charring, of macrobotanical remains,
recording protocols, 219-220	281-283
sources of, 218-219	chemical weathering, strontium and, 101-102
braincase measurement, GMM techniques	cheniers (natural shell mounds), 248-249
for, 206	chirality, of amino acids, 37
	chromosomes, 26
calcium antimonate, in glass, 356	Clovis people, parasite transmission by, 263
canonical variant analysis (CVA), 204	CNV. See copy number variation
carbon isotopes, for diet studies	coalescent theory, 24-25
in animals, 132–133	collagen, proteomics of, 35, 54. See also bone
in bone collagen, 130–133	collagen; non-collagenous proteins
with elemental analysers, 128–129	copper, 366–367
in humans, 137-138	smelting of, 373-374
in plants, 131–132	copy number variation (CNV), 26
ratio measurements, 128–129	cortical bone surface, in skeletal inventory,
carbon reservoirs, 408	148-149
Çayönü Tepesi site, 224	crustaceans, 264
ceramics	CVA. See canonical variant analysis
analysis of, 338-344	
chemical approaches, 342-343	DAGs. See diacylglycerols
fabric, 338-339	dairying, origins of, 85–86
isotopic approaches, 343	Daltons, in MS, 42
mineralogical approaches, 340-342	datasets, integration of, in archaeological
definition of, 335-336	science, 7
global abundance of, 335	dating. See also luminescence dating;
lipid residue analysis of, 74-75, 77-78	radiocarbon dating
for dairying, 85–86	amino acid racemisation (AAR), 37



dating. (cont.)	dentine
of lithics, 394-395	diagenesis in, 103-104
optically stimulation luminescence (OSL)	production of, 171
dating, 426	Andresen lines, 171–172
thermoluminescence (TL) dating, 426	cementum annulations, 171
demineralisation, of bone in diet studies, 127	periradicular lines, 171
Denisovans, 23	tubules, 171
dental calculus, proteomics for, 57	von Ebner lines, 171–172
dental health, 159–162	proteomics for, 57
dental disease and, 162	deoxyribonucleic acid (DNA), 26. See also
infectious disease history, 160	ancient DNA
lesions and, analysis of, 159-160	archaeological residues from, 76
metabolic disease and, 161	endogenous, 27
trauma history, 160–161	exogenous, 27
dental histology. See also tooth development	hydrolysis of, 15
archaeological applications of, 179–185	modern analysis of, compared to aDNA
age estimation at time of death, 179-183	analysis, 20
crown formation time, 179–183	residue analysis of, 79
for developmental stress, 183–185	extraction methods, 79
case study for, 185–187	sequencing of proteins, 39
dentine production, 171	developmental stress, in dental histology
Andresen lines, 171–172	accentuated lines, on tooth roots, 183-184
cementum annulations, 171	accentuated rings, on tooth roots, 183-184
periradicular lines, 171	archaeological applications for, 183–185
tubules, 171	hypoplasias, on crowns, 183–185
von Ebner lines, 171–172	for Scladina juvenile Neanderthal, 186
developmental stress	diacylglycerols (DAGs), 75
accentuated lines, on tooth roots,	diet studies, isotope analysis for
183–184	for bone collagen, 130–138
accentuated rings, on tooth roots,	with carbon isotopes, 130-133
183–184	extraction methods, 126–127
archaeological applications for, 183-185	for measurements of, 126–127
hypoplasias, on crowns, 183–185	with nitrogen isotopes, 128–129
for Scladina juvenile Neanderthal, 186	quality control methods, 126–127
methods of study, 173-179	with carbon
impressions and casts, 173-176	in animals, 132–133
microscopic imaging, 179-181	in bone collagen, 130-133
physical sectioning, 176–178	with elemental analysis, 128–129
with SEM, 179	in humans, 137–138
in Scladina juvenile Neanderthal, 185–187	isotope ratio measurements, 128–129
developmental stress for, 186	in plants, 131–132
serial sampling and isotope analysis, 108,	with nitrogen
112-115	in animals, 135–136
theoretical approach to, 170-173	in bone collagen, 133-137



INDEX 443

from dietary protein, 133-135 with elemental analysers, 128-129 in humans, 136-138 in plants, 133-134 ratio measurements, 128-129 theoretical approach to, 125 diets, reconstruction of, through aDNA, 13-14 direct bonding, of proteins, 75 direct temperature resolved mass spectrometry (DTMS), 76 Discoveries in the Ruins of Ninevah and Babylon (Layard), 5 DNA. See deoxyribonucleic acid DTMS. See direct temperature resolved mass spectrometry

EA-IRMS. See isotope ratio mass spectrometry echinoderms, 264 EDMA. See Euclidean Distance Matrix Analysis Edman degradation sequencing, 38 EDTA. See ethylenediaminetetraacetic acid electron microprobe analysis (EMPA), 392 Electron Probe Micro-Analyser (EPMA), 350-351 electrospray ionisation (ESI), 41-42 elemental analysers, 128-129 EMPA. See electron microprobe analysis enamel. See also tooth development diagenesis in, 103-104 growth of, 171 isotope analysis of, 103-105, 109-110 sequential sampling of, 103-104, 108, 111-115 structure of, 171 enamel prisms, in tooth development, 171 enamels (material culture), 349 endogenous DNA, 27 endoparasites, 262 epitopes, 38 antibodies, 38 epitopes antibodies, 38

EPMA. See Electron Probe Micro-Analyser Ertebølle culture, 223-224 site of, 248 escargotières sites, 243 ESI. See electrospray ionisation ethylenediaminetetraacetic acid (EDTA), 127 Euclidean Distance Matrix Analysis (EDMA), 201 exogenous DNA, 27 extraction methods of ancient DNA, 14-16, 79 in diet studies, for bone collagen, 126-127 of DNA, in residue analysis, 79 of lipids, in residue analysis, 77-78 of proteins, in residue analysis, 78-79

flotation, 286-289 food residues, for proteomics, 56-57 Fourier transform infrared spectroscopy (FTIR), 76 fractionation in carbon isotopes, 130 in nitrogen isotopes, 130, 133-134 in oxygen isotopes, 106 analysis of, 107-108 in radiocarbon dating, 409-410 fracture mechanics, 388-389 controlled experimentation in, 388-389 methodological approaches to, 388 freshwater molluscs, 242-244 palaeoenvironmental reconstructions of, 244-245 FTIR. See Fourier transform infrared spectroscopy

fabric analysis, of ceramics, 338-339

GC-c-IRMS, lipid residue analysis with, 81–83 gender, in human osteology, 154 genes, 26 genetic locus, 27 genetic markers, 26 nuclear, aDNA demographic inference from, 24



genomes, 27	measurement points in, 200
de novo reconstruction of, 18	function of, 198-199
mitochondrial, 27	homology, 199-200
Denisovans, 23	landmarks, 199–200
Neanderthals, 23	methods of, 199-206
Sima de los Huesos, 19-20	core, 201–206
next generation sequencing, 17–19	CVA, 204
nuclear, aDNA from	EDMA, 201
data analysis of, 22	procrustes superimposition, 199,
recombination processes, 22	201–202
whole sequences for, with aDNA, 19	semilandmarks, 202-203, 207-209
baits in, 19	statistical analysis in shape space, 203-204
woolly mammoth, 25–26	statistical significance tests, 204-205
genotypes, 27–28	thin-plate spline interpolation, 202
geoarchaeology	for Neanderthal newborn, virtual
definition of, 314	reconstruction of, 205
landscape, 315-319	purpose of, 198–199
burial site location prediction, 316-317	theoretical approach to, 198–199
human impact studies, 318-319	glass
landform changes in, 317-318	analysis of, 349-351, 359
objectives of, 315-319	chemical, 350-351
site reconstruction in, 317	with EPMA, 350-351
at Makri site, 322–323	isotopic, 357-358
methodologies of, 319	with LA-ICPMS, 357
on-site, 320-324	with micrographs, 351
cultural deposits in, 320-321	through provenance, 356-358
methodological techniques for, 320	with SEM-EDS, 350-351
natural sedimentary features, 322	beads, for trade, 354
non-sedimentary processes, 318-321	composition of, 352-356
theoretical approach to, 314-315, 324	calcium antimonate in, 356
at Wilson-Leonard site, 321	colouring elements in, 355-356
Geological Evidences of the Antiquity of Man	geographic factors in, 353-355
(Lyell), 314	lead, 355
geometric morphometric (GMM)	natron in, 353
techniques	plant ash in, 353
allometry and, 207	potash, 353
applications of, 206–210	silica, 352–353
for braincase measurement, 206	trace elements in, 356-358
for change in body size, 207	early production of, 347
for Homo sapiens, 207–209	raw materials in, 348
for tooth development, 209–210	technologies in, 358
case studies, 205	in enamels, 349
data sources in, 200	formation processes, 347-348
estimation of missing data, 204-206	raw materials in, 348



INDEX 445

ICP-MS. See inductively coupled mass in glazes, 349 spectrometry human-made, 352-353 incomplete lineage sorting, 23 mass commodification of, 349-353 provenancing of, 356-358 inductively coupled mass spectrometry raw materials (ICP-MS), 392 with laser ablation (LA-ICPMS), 357 composition of, 352-356 with laser ablation (LA-MC-IP-MS), 105 in early production, 348 in formation processes, 348 with multi-collector (MC-ICP-MS), glass beads, 354 104-105 glazes, 349 infectious disease, 160 glutamine, 39 inheritance mechanisms, in aDNA, 22-23 GMM techniques. See geometric insects, zooarchaeology for, 234-242 morphometric techniques advanced studies of, 241-242 gold, 374-375 archaeoentomology and, 237-241 at Coppergate site, 238-239 habitus practice theory, 292 MCR method, 236 palaeoentomology and, 235-237 HBE. See human behavioural ecology HCI. See hydrochloric acid parasitic species, 240-241 heirloom parasites, 263 synanthropic species, 239-240 Hermopolis Magna site, 226 invertebrate zooarchaeology, 260-264. See High Throughput Sequencing, 17-19. See also insects; molluscs also Next Generation Sequencing aquatic invertebrates, 264 hominins, 19-20. See also Denisovans; crustaceans, 264 Neanderthals; Sima de los Huesos echinoderms, 264 Homo sapiens, GMM techniques for, sponges, 264 207-209 for mites, 263-264 human behavioural ecology (HBE), for parasitic worms, 261-263 Clovis people and, 263 291-292 human-made glass, 352-353 endoparasites, 262 humans heirloom parasites, 263 aDNA in, 23 human populations and, 262-263 Anatomically Modern Humans, 416-417 preservation protocols in, 233-234 diet studies for for protozoans, 260-261 with carbon isotopes, 137-138 quantification protocols in, 233-234 with nitrogen isotopes, 136-138 recovery protocols in, 233-234 genetic evidence for evolution of, theoretical approach to, 233 ionisation, 41-42 20-21 mobility studies for ESI, 41-42 with oxygen isotopes, 110 MALDI, 41-42 with strontium isotopes, 103 iron, metallurgy with, 375-376 hydrochloric acid (HCI), use of in collagen alloys and, 376 extraction, 127 Iron Age, 375-376 hydrolysis, of peptides, 39 isoscapes. See bioavailability; oxygen hypoplasias, on tooth crowns, 183-185 isotopes



isotope analysis. See also diet studies	with strontium, in mobility studies, 110
of animals, as baselines, 135–136	tissue offsets, 107
of bioapatites, 100	standards, 128–129
in carbonate components, 109-110	Ambient Inhalable Reservoir (AIR), 134
with oxygen, 109	V-PBD, 130–131
in phosphate components, 109	V-SMOW, 105-110
with strontium, 103-105	strontium, 101-105
carbon	basic principles of, 101
in animals, 132-133	in bioapatites, 103–105
basic principles of, 130-133	bioavailability of, 101-103
in bone collagen, 130-133	diagenesis and, 103-104
with elemental analysers, 128–129	in migration studies of caribou/
in humans, 137–138	reindeer, 111-115
in plants, 131–132	with oxygen, in mobility studies, 110
ratio measurements, 128-129	theoretical approach to, 99-100
in carbonate components, 109-110	transhumance and, 99-100
in case studies, 111–115	isotope ratio mass spectrometry (EA-IRMS),
of dietary change with agriculture, 125	76
migration studies of caribou/reindeer,	
111–115	joint disease, skeletal health and, 161
of ceramics, 343	Jonzac site, 112, 114
of glass, 357–358	Journal of Archaeological Science (journal), 6
at Jonzac site, 112, 114	
lead isotope analysis (LIA), in	Kamid el-Lo site, 217
archeometallurgy, 380-381	keratins, 53
nitrogen	
in animals, as baselines, 135-136	LA-ICPMS. See inductively coupled mass
basic principles of, 136	spectrometry
in bone collagen, 133-137	landmarks, in GMM techniques, 199–200
breastfeeding and, 136	landscape geoarchaeology, 315–319
from dietary protein, 133–135	burial site location prediction, 316-317
with elemental analysers, 128–129	human impact studies, 318-319
in humans, 136-138	landform changes in, 317-318
in plants, 133–134	objectives of, 315-319
ratio measurements, 128-129	site reconstruction in, 317
oxygen, 105-110	Layard, Austen Henry, 5
basic principles of, 105	lead
of bioapatites, 109-110	in glass, 355
fractionation in, 107–108	metallurgy with, 374-375
of obligate drinkers, in palaeoclimate	Lead Isotope Analysis (LIA), 380–381
reconstruction, 107	Leeuwenhoeck, Anthony, 170
sampling approach, 108	lesions, dental health and, 159–160
standards (V-PDB, VSMOW),	LIA. See Lead Isotope Analysis
105-110	lineage sorting. See incomplete lineage sorting



lipids	theoretical approach to, 424–425
as archaeological residue, 76	thermoluminescence (TL) dating, 394-395
DAGs, 75	Lyell, Charles, 314
degradation of, 74-75	
MAGs, 75	macrobotanical remains, 276–279
TAGs, 74-75	charring of, 281-283
residue analysis of, 77-78	flotation as extraction method for,
with GC-c-IRMS, 81-83	286-289
methodological approaches to, 77	taphonomy of, 279-282
from plants, 84	water recovery methods, 287
for species identification, 83	MAGs. See monoacylglycerols
Liquid Scintillation Counters, 408-409	Makri site, geoarchaeology at, 322–323
lithic analysis	MALDI. See Matrix Assisted Laser
fracture mechanics, 388-389	Desorption Ionisation
controlled experimentation in, 388-389	marine foods, identification of, 86-87
methodological approaches to, 388	marine molluscs, 247-254
function of, 396-398	archaeological shell assemblages, 250-251
for tool shape analysis, 399-400	cheniers and, 248-249
in use-wear studies, 396–398	midden formation processes, 247-250, 252
of raw materials, 389–396	shell morphometrics, 251–254
geochemical analysis of, 391-393.	shell taphonomy, 247–250
See also specific techniques	thanatocoenosis, 249
heat treatment of, 393-396	mass spectrometry (MS), 40-48
quality factors for, 390–391	AMS, 409
sourcing of, 391	archaeological applications of, 49-58
theoretical approach to, 387	CF-IRMS, 128
thermoluminescence dating, 394-395	Daltons in, 42
luminescence dating	detection, 42-46
applications of, 424–425	of targeted single proteins, 52-53
in archaeological contexts, 433-434	DTMS, 76
future, 434	EA-IRMS, 76
daylight resetting complications, 431–432	essential principles of, 40-41
dose rates in, 432	GC-c-IRMS, 81–83
maximum age range with, 431	ICP-MS, 392
in natural environments, 426-427	interpretation of, 45-48
optically stimulated luminescence (OSL)	LA-ICPMS, 357
dating, 426	LA-MC-ICP-MS, 105
physical mechanisms for, 425-426	MC-ICP-MS, 105
post-depositional mixing, 432–433	PyMS, 76
practical applications of, 427–430	tandem (MS/MS), 43-56
environmental dose rate estimation,	theoretical background for, 35-40
429-430	thermal ionisation mass spectrometry
laboratory preparation in, 429	(TIMS), 104
sampling of materials, 427–429	ZooMS, 54



Matrix Assisted Laser Desorption Ionisation	mites, 263-264
(MALDI), 41–42	mitochondria
MCR method. See Mutual Climactic Range	aDNA from
method	in case studies, 19–20
Meehan, Betty, 247	data analysis of, 22
metabolic disease, 161	inheritance mechanisms, 22-23
metallurgy, 368-377. See also	genomes, 27
archaeometallurgy	M/MS sequence series, 46–48
definition of, 368-369	MNI method. See Minimum Number of
early, 366-367, 370	Individuals method
with gold, 374-375	molecular clock, 26-27
with iron, 375-376	molluscs, zooarchaeology for, 242-260
alloys and, 376	archaeomalacology, 242
with lead, 374-375	freshwater, 242-244
LIA, 380-381	palaeoenvironmental reconstructions
mining and	of, 244-245
archaeology of, 371	marine, 247-254
in primary production, 370-371	archaeological shell assemblages,
multiple origins of, 369	250-251
as practice, 370-377	cheniers and, 248–249
primary production in, 370-373	midden formation processes, 247-250
beneficiation, 370-371	252
mining, 370-371	shell morphometrics, 251-254
with silver, 374-375	shell taphonomy, 247-250
smelting, 372-374	thanatocoenosis, 249
copper, 373-374	sclerochronology, 254-257
slag from, 373	shells
metals. See also archaeometallurgy	carbonate geochemistry for, 254-257
copper, 366-367	in marine molluscs, 247-254
cultural fascination with, 365-366	as ornaments and tools, 257-259
during Iron Age, 375-376	provenance studies of, 259-260
native, as stones, 366-367	shape of, environmental data from,
Neolithic technology for, 367	254
purpose and function of, 377-378	size studies for, 253-254
quantification of production of, 377	terrestrial, 242–244
microbotanical remains, 276-286	escargotières sites, 243
of starches, 284	ethnoarchaeological investigations of,
taphonomy of, 281–282	243-244
migration studies of caribou/reindeer, 111-115	geochemical studies on, 245-247
Minimum Number of Individuals (MNI)	palaeoenvironmental reconstructions
method, 221	of, 244–245
mining, metallurgy and	taphonomic studies, 243
archaeology of, 371	monoacylglycerols (MAGs), 75
in primary production, 370-371	Moundville chiefdom, 294



> INDEX 449

MRE hypotheses. See multiregional evolution hypotheses MS. See mass spectrometry MS/MS. See tandem mass spectrometry multiregional evolution (MRE) hypotheses, mummified remains, proteomics for, 58 mutations, 27 Mutual Climactic Range (MCR) method, Mycenae (Schielmann), 5

NAA. See neutron activation analysis native metals, as stones, 366-367 natron glass, 353 natural shell mounds. See cheniers NCPs. See non-collagenous proteins NCT. See Niche Construction Theory Neanderthals

aDNA from, 23

GMM techniques for, in virtual reconstruction of newborns, 205 Jonzac site, 112, 114

Scladina juvenile, dental histology for, 185-187

developmental stress for, 186 Neolithic technology, for metals, 367 neutron activation analysis (NAA), 392 New Archaeology, 5

Next Generation Sequencing (NGS), 17-19 reconstruction of genomes in, 18 Sanger sequencing compared to, 18 NGS read, 27

Niche Construction Theory (NCT), 291-293 processing of plants as food, 293

NISP. See Number of Identified Specimens Present method

nitrogen isotopes, for diet studies in animals, as baselines, 135-136 in bone collagen, 133-137 breastfeeding and, 136

from dietary protein, 133-135 with elemental analysers, 128-129

in humans, 136-138

in plants, 133-134 ratio measurements, 128-129 NMR spectroscopy. See nuclear magnetic resonance spectroscopy non-collagenous proteins (NCPs), 40 nuclear genetic markers, aDNA demographic inference from, 24 nuclear magnetic resonance (NMR) spectroscopy, 76 Number of Identified Specimens Present (NISP) method, 220-221 numerical skeletal inventory, 151

on-site geoarchaeology, 320-324 cultural deposits in, 320-321 methodological techniques for, 320 natural sedimentary features, 322 non-sedimentary processes, 318-321 osteology, human apical root translucency method, 154 dental health, 159-162 dental disease, 162 infectious disease history, 160 lesions and, analysis of, 159-160 metabolic disease and, 161 trauma history, 160-161 gender and, 154 palaeodemographic data, 152-156 age in, 152-154 gender factors, 154 human life cycle stages, 152-154 minimum number of individuals, 152 sex in, 154-156 population health, 162 sex determination, 154-156 female skull and pelvis, 155 male skull and pelvis, 155 skeletal health, 159-162 infectious disease history, 160 joint disease, 161 lesions and, analysis of, 159-160 metabolic disease, 161

trauma history, 160-161

skeletal inventory in, 147-149



450 INDEX

osteology, human (cont.) identification procedures, 289-291 cortical bone surface, 148-149 sample processing procedures, 286-289 microbotanical remains, 276-286 numerical, 151 skeleton. See skeletal inventory of starches, 284 theoretical approach to, 147 taphonomy of, 281-282 Moundville chiefdom, 294 oxygen isotopes in animal bioapatites, 107-109 palynology, 283-285 phytoliths, 283 basic principles of, 105 of bioapatites, 109-110 processual archaeological framework, fractionation, 106-108 291-293 in human bioapatites, 107-109 habitus practice theory, 292 HBE and, 291-292 in hydrosphere, 105-106 NCT and, 291-293 evaporation processes, 106 seed reference collections, 291 in migration studies of caribou/reindeer, starches, 282-283 naturally-occurring isotopes, 105 microbotanical remains of, 284 sampling approach, 108 taphonomy standards (V-PDB, VSMOW), 105-110 charring and, 281-283 of macrobotanical remains, 279-282 with strontium, in mobility studies, 110 of microbotanical remains, 281-282 palaeobotany. See palaeoethnobotany themes of, 278 theoretical approach to, 276-279 palaeodemographic data, 152-156 age in, 152-154 palynology, 283-285 parasitic worms, 261-263 gender and sex in, 154 human life cycle stages, 152-154 Clovis people and, 263 minimum number of individuals, 152 endoparasites, 262 sex in, 154-156 heirloom parasites, 263 palaeoethnobotany human populations and, 262-263 anthracology and, 276-277 particle induced gamma ray emission analysis (PIGME), 392 anthropogenesis in, 277 case studies for, 293-296 particle induced X-ray emission analysis in ceremonial and ritual uses of plants, (PIXIE), 392 PCR method. See polymerase chain reaction in early urban environments, 294-295 method domestication of species in, 277 Pee Dee Belemnite, 110, 130-131 equipment for, 279-291 peptide mass fingerprinting (PMF), macrobotanical remains, 276-279 45-48 charring of, 281-283 peptides, 38 flotation as extraction method for, Edman degradation sequencing, 38 286-289 false discovery rates for, 48 hydrolysis of, 39 taphonomy of, 279-282 water recovery methods, 287 M/MS sequence series, 46-48 methodologies in, 279-291 PMF, 45-48 field sampling, 285-286 Percy, John, 5



INDEX 451

perikymata, in tooth development, 171 quality control methods, 126-127 use of in palaeodietary studies, 126-127 phenotypes, 27-28 phylogeographic inference, for aDNA, 24 degradation of, 38-39 phytoliths, 283 dietary, isotope analysis of, 130-135 PIGME. See particle induced gamma ray DNA sequencing of, 39 emission analysis epitopes and, 38 antibodies, 38 PIXIE. See particle induced X-ray emission analysis keratins, 53 plant ash glass, 353 NCP, 40 plant lipids, 84 peptides and, 38 plants. See also palaeoethnobotany Edman degradation sequencing, 38 in diet studies false discovery rates for, 48 with carbon isotopes, 131-132 hydrolysis of, 39 with nitrogen isotopes, 133-134 M/MS sequence series, 46-48 processing of, as food, 293 PMF, 45-48 PLM. See polarising light microscope post-translational modifications of, 38-39 PMF. See peptide mass fingerprinting proteomics for, in protein mixtures, 54-55 polarising light microscope (PLM), 340-341 complex mixtures, 55 pollen, study of. See palynology simple mixtures, 54-55 polymerase chain reaction (PCR) method residue analysis of, 78-79 defined, 28 extraction and separation methods, in Sanger sequencing, 17 silk, 53 polymerisation of proteins, 75 population health, human osteology and, 162 targeted single, 49-53 population history, 26-27 case studies for, 50-52 potash, in glass, 353 detection with mass spectrometry, pottery vessels, proteomics for, 56 52-53 procrustes superimposition, in GMM proteomes, 35, 55 bone, 57 techniques, 199, 201-202 proteins. See also proteomics proteomics. See also mass spectrometry amino acids, 35-37 for bone proteomes, 57 asparagine, 39 for collagen, 35, 54 chirality of, 37 for dental calculus, 57 complex structure of, 37 for dentine, 57 glutamine, 39 for food residues, 56-57 ancient ionisation, 41-42 recovery of, 36-37 ESI, 41-42 survival of, 39-40 MALDI, 41-42 as archaeological residue, 75-76 for keratins, 53 direct bonding of, 75 for mummified remains, 58 polymerisation of, 75 for pottery vessels, 56 bone collagen for protein mixtures, 54-55 extraction of, 127 complex, 55 for measurements, 126-127 simple, 54-55



proteomics. (cont.)	case studies, 84-87
for seeds, 55–56	for identification of marine foods, 86-87
for silk proteins, 53	for origins of dairying, 85-86
for targeted single proteins, 49–53	of DNA, 79
case studies for, 50-52	extraction methods, 79
detection with mass spectrometry, 52-53	DTMS, 76
through enrichment methods, 52	EA-IRMS, 76
protozoans, 260–261	equipment for, 76-79
pyrolysis mass spectrometry (PyMS), 76	FTIR, 76
	function and purpose of, 70-71
quality assurance, in radiocarbon dating,	of lipids, 77–78
416–421	with GC-c-IRMS, 81-83
for age of sample, 414	methodological approaches to, 77
contamination protocols, 414–415	from plants, 84
procedures for, 415-416	for species identification, 83
quality control methods, for diet studies,	NMR spectroscopy, 76
126–127	of proteins, 78–79
	extraction and separation methods,
radiocarbon dating	78-79
age modelling, 412-413	PyMS, 76
aging through, 408	theoretical background for, 70-71
calibration of, over time, 410-413	residues, archaeological
carbon reservoirs, 408	composition of, 73-74
case studies for, 416-418	classifications in, 73
for Anatomically Modern Humans,	preservation mechanisms in, 74
416-417	stabilisation mechanisms in, 74
in Palaeolithic sites, 417–418	from DNA, 76
counting errors, 409	lipids, 74-75
fractionation correction, 409-410	DAGs, 75
half-life, 407	degradation of, 74–75
as measurement tool, 408-409	MAGs, 75
with AMS, 409	TAGs, 74-75
Liquid Scintillation Counters, 408-409	preservation of, 74–76
pre-treatment processes, 416-421	mechanisms of, 74
principles of, 407-408	proteins, 75–76
quality assurance in, 416–421	direct bonding of, 75
for age of sample, 414	polymerisation of, 75
contamination protocols, 414-415	visible, 80–81
procedures for, 415-416	Retzius lines, in tooth development, 171-172
recent African origins (RAO) hypothesis, 21	rocks. See lithic analysis
residue analysis	
from artefacts, 71-75	Sanger sequencing, 17–19
formation of, 71	NGS compared to, 18
in visible deposits, 80-81	PCR method in, 17



INDEX 453

Scanning Electron Microscope (SEM), 341 SEM-EDS, 350-351 Scanning Electron Microscope with attached **Energy Dispersive Spectrometer** (SEM-EDS), 350-351 scanning electron microscopy, for dental histology, 179 Schielmann, Heinrich, 5 Scladina juvenile Neanderthal, dental histology of, 185-187 developmental stress for, 186 sclerochronology, 254-257 proteomics for, 55-56 reference collections, 291 SEM. See Scanning Electron Microscope SEM-EDS. See Scanning Electron Microscope with attached Energy Dispersive Spectrometer semilandmarks, in GMM techniques, 202-203, 207-209 separation methods, of proteins, in residue analysis, 78-79 serial founder effect, 20-21 sex, palaeodemographic data influenced by, 154-156 determination in osteoarcheology, 155 Shell bed to Shell Midden (Meehan), 247 shells, mollusc carbonate geochemistry for, 254-257 in marine molluscs, 247-254 as ornaments and tools, 257-259 provenance studies of, 259-260 shape of, environmental data from, 254 size studies for, 253-254 silica, in glass, 352-353 silk proteins, 53 silver, 374-375 Sima de los Huesos, 19-20 Sindos cemetery site, 217 site geoarchaeology. See on-site geoarchaeology skeletal health, 159-162 infectious disease history, 160

joint disease and, 161 lesions and, analysis of, 159-160 metabolic disease and, 161 trauma history, 160-161 skeletal inventory, 147-149 cortical bone surface, 148-149 numerical, 151 slag, from smelting, 373 smelting, 372-374 of copper, 373-374 slag from, 373 soft ionisation. See electrospray ionisation; ionisation; Matrix Assisted Laser Desorption Ionisation spectroscopy. See specific types sponges, 264 spores, study of. See palynology starches, 282-283 microbotanical remains of, 284 stone tools. See lithic analysis stratigraphy, in archaeological science, 5 strontium isotopes, 101-105 in animals, 103 basic principles of, 101 in bioapatites, 103-105 bioavailability of, 101-103 chemical weathering and, 101-102 estimation of, 101-103 mixing in, 102 outputs in, 102 diagenesis and, 103-104 in humans, 103 of migration studies of caribou/reindeer, naturally-occurring isotopes of, 101 with oxygen, in mobility studies, 110

TAGs. See triacylglycerols tandem mass spectrometry (MS/MS), 43–56 taphonomy, in palaeoethnobotany charring and, 281–283 of macrobotanical remains, 279–282 of microbotanical remains, 281–282



454 INDEX

terrestrial molluscs, 242-244 escargotières sites, 243 ethnoarchaeological investigations of, 243-244 geochemical studies on, 245-247 palaeoenvironmental reconstructions of, 244-245 taphonomic studies, 243 thanatocoenosis, 249 thermoluminescence dating, 394-395 thin-plate spline interpolation, in GMM techniques, 202 tooth development, 171 cross-striations in, 171 enamel prisms, 171 GMM techniques and, 209-210 perikymata in, 171 periodicity in, 171 Retzius lines, 171-172 vertebrate zooarchaeology and, 222 transhumance, 99-100 trauma, 160-161 triacylglycerols (TAGs), 74-75

unusual ceramics, 343-344 use-wear studies, lithic analysis in, 396-398

vertebrate zooarchaeology
at Abu Hureyra site, 223–224
animal remains, sources of, 216–219
bone recovery, 218–219
from killing and cooking, 216–218
preservation of bones, 218
bones, 219–222
as data source, 222–227
identification of, 219–220
preservation of, 218
quantification and calculation of, 220–221

reconstruction of living animals from, 221-222 recording protocols for, 219-220 sources of, 218-219 at Çayönü Tepesi site, 224 at Coppergate site, 225 for craft and industry data, 225 domestication of species data, 224 at Hermopolis Magna site, 226 at Kamid el-Lo site, 217 MNI method in, 221 NISP method in, 220-221 for religious ceremonies, 226-227 at Ringkloster site, 223-224 for ritual activities, 226-227 settlement reconstruction from, 223-224 at Sindos cemetery site, 217 for social status and identity data, 225-226 theoretical approach to, 215-216 tooth development and, 222

wares, ceramics as, 340
water recovery methods, in
palaeoethnobotany, 287
Wilson-Leonard site, geoarchaeology at, 321
wood charcoal, study of. *See* anthracology
woolly mammoth genomes, 25–26

X-ray diffraction (XRD), 393 X-ray fluorescence (XRF), 392 XRD. See X-ray diffraction XRF. See X-ray fluorescence

zooarchaeology, 215–216. See also insects; invertebrate zooarchaeology; molluscs; vertebrate zooarchaeology definition of, 216 Zooarchaeology by Mass Spectrometry (ZooMS), 54