Supplementary Material

**Supplementary table 1**: Ca, P, and Ca/P data (measured by hXRF) for the surfaces of eight modern human femora from the UC Anthropology Department’s Comparative Osteology teaching collection. Thirty locations were scanned on each femur (see **Figure 1** in main text). Locations with Ca/P values higher than 2.3 are bolded and italicized. OL0364 is a subadult; all other individuals are adults.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Specimen ID | Location | Ca (x1000, ppm) | Ca error (ppm; ±2 s.d.) | P (x1000, ppm) | P error (ppm; ±2 s.d.) | Ca/P | Near growth plate |
| OL0333 | 1 | 149 | 289 | 90 | 509 | 1.7 | Yes |
| 2 | 210 | 370 | 126 | 645 | 1.7 | No |
| 3 | 231 | 396 | 143 | 698 | 1.6 | Yes |
| 4 | 103 | 235 | 53 | 389 | 1.9 | Yes |
| 5 | 213 | 373 | 138 | 675 | 1.5 | Yes |
| 6 | 189 | 343 | 116 | 608 | 1.6 | No |
| 7 | 231 | 396 | 150 | 715 | 1.5 | No |
| 8 | 186 | 341 | 115 | 603 | 1.6 | No |
| 9 | 96 | 226 | 51 | 378 | 1.9 | No |
| 10 | 180 | 332 | 106 | 577 | 1.7 | No |
| 11 | 179 | 330 | 94 | 546 | 1.9 | No |
| 12 | 121 | 259 | 58 | 413 | 2.1 | No |
| 13 | 49 | 156 | 23 | 249 | 2.1 | No |
| 14 | 174 | 328 | 95 | 549 | 1.8 | Yes |
| 15 | 193 | 350 | 104 | 581 | 1.9 | Yes |
| 16 | 237 | 401 | 156 | 734 | 1.5 | Yes |
| 17 | 190 | 345 | 120 | 617 | 1.6 | No |
| 18 | 176 | 327 | 102 | 564 | 1.7 | Yes |
| 19 | 127 | 266 | 71 | 454 | 1.8 | No |
| 20 | 122 | 262 | 65 | 437 | 1.9 | No |
| 21 | 65 | 181 | 31 | 291 | 2.1 | Yes |
| 22 | 175 | 325 | 95 | 546 | 1.8 | No |
| 23 | 231 | 392 | 144 | 699 | 1.6 | No |
| 24 | 186 | 338 | 108 | 584 | 1.7 | No |
| 25 | 52 | 161 | 26 | 262 | 2.0 | No |
| 26 | 64 | 180 | 30 | 286 | 2.1 | Yes |
| 27 | 47 | 153 | 21 | 241 | 2.2 | Yes |
| 28 | 208 | 368 | 116 | 621 | 1.8 | Yes |
| 29 | 154 | 302 | 80 | 495 | 1.9 | Yes |
| 30 | 207 | 366 | 127 | 646 | 1.6 | No |
| OL0340 | 1 | 182 | 335 | 88 | 533 | 2.1 | Yes |
| 2 | 205 | 364 | 92 | 561 | 2.2 | No |
| 3 | 178 | 333 | 63 | 461 | ***2.8*** | Yes |
| 4 | 55 | 167 | 25 | 259 | 2.2 | Yes |
| 5 | 174 | 325 | 99 | 557 | 1.8 | Yes |
| 6 | 27 | 113 | 13 | 191 | 2.1 | No |
| 7 | 171 | 321 | 97 | 549 | 1.8 | No |
| 8 | 180 | 330 | 92 | 537 | 2.0 | No |
| 9 | 132 | 272 | 70 | 455 | 1.9 | No |
| 10 | 116 | 254 | 56 | 404 | 2.1 | No |
| 11 | 197 | 351 | 118 | 614 | 1.7 | No |
| 12 | 173 | 322 | 94 | 541 | 1.8 | No |
| 13 | 112 | 235 | 55 | 382 | 2.0 | No |
| 14 | 212 | 373 | 108 | 606 | 2.0 | Yes |
| 15 | 157 | 307 | 66 | 466 | ***2.4*** | Yes |
| 16 | 214 | 373 | 126 | 652 | 1.7 | Yes |
| 17 | 199 | 358 | 93 | 558 | 2.1 | No |
| 18 | 193 | 368 | 113 | 592 | 1.7 | Yes |
| 19 | 180 | 329 | 100 | 562 | 1.8 | No |
| 20 | 177 | 328 | 100 | 560 | 1.8 | No |
| 21 | 176 | 323 | 94 | 540 | 1.9 | Yes |
| 22 | 218 | 377 | 126 | 650 | 1.7 | No |
| 23 | 168 | 316 | 94 | 537 | 1.8 | No |
| 24 | 160 | 307 | 87 | 515 | 1.8 | No |
| 25 | 87 | 211 | 43 | 346 | 2.0 | No |
| 26 | 56 | 166 | 25 | 264 | 2.2 | Yes |
| 27 | 162 | 309 | 93 | 531 | 1.7 | Yes |
| 28 | 90 | 216 | 45 | 357 | 2.0 | Yes |
| 29 | 61 | 175 | 26 | 266 | 2.3 | Yes |
| 30 | 65 | 182 | 32 | 307 | 2.0 | No |
| OL0365 | 1 | 99 | 231 | 40 | 349 | ***2.5*** | Yes |
| 2 | 201 | 358 | 106 | 591 | 1.9 | No |
| 3 | 173 | 324 | 76 | 493 | 2.3 | Yes |
| 4 | 86 | 212 | 41 | 343 | 2.1 | Yes |
| 5 | 198 | 354 | 115 | 609 | 1.7 | Yes |
| 6 | 101 | 230 | 52 | 377 | 1.9 | No |
| 7 | 101 | 233 | 55 | 395 | 1.8 | No |
| 8 | 166 | 315 | 92 | 534 | 1.8 | No |
| 9 | 142 | 285 | 75 | 475 | 1.9 | No |
| 10 | 88 | 215 | 44 | 352 | 2.0 | No |
| 11 | 184 | 338 | 108 | 585 | 1.7 | No |
| 12 | 165 | 314 | 91 | 529 | 1.8 | No |
| 13 | 87 | 212 | 42 | 341 | 2.1 | No |
| 14 | 188 | 347 | 84 | 528 | 2.2 | Yes |
| 15 | 167 | 320 | 67 | 468 | ***2.5*** | Yes |
| 16 | 87 | 216 | 34 | 319 | ***2.6*** | Yes |
| 17 | 180 | 335 | 88 | 536 | 2.0 | No |
| 18 | 196 | 353 | 105 | 586 | 1.9 | Yes |
| 19 | 122 | 262 | 56 | 410 | 2.2 | No |
| 20 | 139 | 282 | 70 | 462 | 2.0 | No |
| 21 | 153 | 300 | 87 | 511 | 1.8 | Yes |
| 22 | 177 | 329 | 102 | 566 | 1.7 | No |
| 23 | 211 | 370 | 121 | 634 | 1.7 | No |
| 24 | 206 | 360 | 121 | 624 | 1.7 | No |
| 25 | 86 | 212 | 42 | 342 | 2.0 | No |
| 26 | 178 | 330 | 100 | 563 | 1.8 | Yes |
| 27 | 167 | 316 | 95 | 544 | 1.8 | Yes |
| 28 | 166 | 324 | 64 | 463 | 2.6 | Yes |
| 29 | 165 | 318 | 78 | 497 | 2.1 | Yes |
| 30 | 149 | 293 | 80 | 492 | 1.9 | No |
| OL0375 | 1 | 205 | 363 | 110 | 603 | 1.9 | Yes |
| 2 | 226 | 391 | 114 | 626 | 2.0 | No |
| 3 | 174 | 328 | 92 | 540 | 1.9 | Yes |
| 4 | 167 | 314 | 96 | 542 | 1.7 | Yes |
| 5 | 200 | 355 | 112 | 603 | 1.8 | Yes |
| 6 | 204 | 359 | 122 | 631 | 1.7 | No |
| 7 | 117 | 255 | 59 | 414 | 2.0 | No |
| 8 | 223 | 384 | 131 | 660 | 1.7 | No |
| 9 | 164 | 314 | 89 | 523 | 1.8 | No |
| 10 | 146 | 289 | 80 | 488 | 1.8 | No |
| 11 | 180 | 331 | 100 | 561 | 1.8 | No |
| 12 | 206 | 359 | 118 | 617 | 1.7 | No |
| 13 | 145 | 293 | 73 | 478 | 2.0 | No |
| 14 | 148 | 293 | 84 | 501 | 1.8 | Yes |
| 15 | 171 | 323 | 88 | 529 | 1.9 | Yes |
| 16 | 193 | 348 | 113 | 601 | 1.7 | Yes |
| 17 | 147 | 293 | 81 | 493 | 1.8 | No |
| 18 | 170 | 321 | 97 | 551 | 1.8 | Yes |
| 19 | 134 | 279 | 65 | 441 | 2.1 | No |
| 20 | 128 | 271 | 60 | 428 | 2.1 | No |
| 21 | 54 | 164 | 24 | 256 | 2.3 | Yes |
| 22 | 98 | 228 | 51 | 377 | 1.9 | No |
| 23 | 196 | 359 | 121 | 621 | 1.6 | No |
| 24 | 220 | 378 | 126 | 649 | 1.7 | No |
| 25 | 134 | 277 | 63 | 432 | 2.1 | No |
| 26 | 107 | 241 | 56 | 401 | 1.9 | Yes |
| 27 | 189 | 342 | 112 | 595 | 1.7 | Yes |
| 28 | 94 | 224 | 43 | 349 | 2.2 | Yes |
| 29 | 194 | 349 | 120 | 618 | 1.6 | Yes |
| 30 | 225 | 385 | 141 | 685 | 1.6 | No |
| OL0420 | 1 | 221 | 382 | 131 | 663 | 1.7 | Yes |
| 2 | 213 | 375 | 132 | 661 | 1.6 | No |
| 3 | 210 | 372 | 118 | 626 | 1.8 | Yes |
| 4 | 111 | 245 | 55 | 400 | 2.0 | Yes |
| 5 | 195 | 348 | 84 | 528 | 2.3 | Yes |
| 6 | 181 | 335 | 111 | 589 | 1.6 | No |
| 7 | 125 | 265 | 67 | 443 | 1.9 | No |
| 8 | 103 | 236 | 53 | 388 | 1.9 | No |
| 9 | 157 | 305 | 86 | 516 | 1.8 | No |
| 10 | 186 | 337 | 111 | 590 | 1.7 | No |
| 11 | 204 | 360 | 124 | 635 | 1.6 | No |
| 12 | 205 | 361 | 123 | 633 | 1.7 | No |
| 13 | 131 | 271 | 73 | 463 | 1.8 | No |
| 14 | 214 | 375 | 132 | 666 | 1.6 | Yes |
| 15 | 59 | 171 | 30 | 290 | 2.0 | Yes |
| 16 | 219 | 382 | 131 | 664 | 1.7 | Yes |
| 17 | 159 | 309 | 84 | 511 | 1.9 | No |
| 18 | 112 | 249 | 58 | 409 | 1.9 | Yes |
| 19 | 190 | 348 | 88 | 541 | 2.2 | No |
| 20 | 206 | 367 | 108 | 602 | 1.9 | No |
| 21 | 119 | 257 | 65 | 433 | 1.8 | Yes |
| 22 | 199 | 353 | 120 | 620 | 1.7 | No |
| 23 | 210 | 367 | 128 | 647 | 1.6 | No |
| 24 | 198 | 352 | 120 | 622 | 1.7 | No |
| 25 | 65 | 181 | 31 | 292 | 2.1 | No |
| 26 | 73 | 194 | 34 | 308 | 2.1 | Yes |
| 27 | 23 | 115 | 11 | 174 | 2.1 | Yes |
| 28 | 64 | 180 | 30 | 290 | 2.1 | Yes |
| 29 | 86 | 212 | 42 | 345 | 2.0 | Yes |
| 30 | 84 | 210 | 43 | 347 | 2.0 | No |
| OL0421 | 1 | 161 | 310 | 92 | 531 | 1.8 | Yes |
| 2 | 60 | 173 | 30 | 288 | 2.0 | No |
| 3 | 160 | 310 | 98 | 548 | 1.6 | Yes |
| 4 | 93 | 222 | 50 | 374 | 1.9 | Yes |
| 5 | 144 | 293 | 92 | 524 | 1.6 | Yes |
| 6 | 195 | 357 | 131 | 650 | 1.5 | No |
| 7 | 165 | 315 | 109 | 579 | 1.5 | No |
| 8 | 83 | 208 | 47 | 358 | 1.8 | No |
| 9 | 137 | 282 | 87 | 509 | 1.6 | No |
| 10 | 158 | 305 | 97 | 541 | 1.6 | No |
| 11 | 189 | 348 | 115 | 605 | 1.6 | No |
| 12 | 161 | 308 | 91 | 526 | 1.8 | No |
| 13 | 117 | 253 | 62 | 423 | 1.9 | No |
| 14 | 180 | 336 | 112 | 598 | 1.6 | Yes |
| 15 | 100 | 233 | 58 | 407 | 1.7 | Yes |
| 16 | 176 | 344 | 69 | 483 | ***2.6*** | Yes |
| 17 | 177 | 330 | 114 | 597 | 1.6 | No |
| 18 | 169 | 320 | 72 | 480 | 2.3 | Yes |
| 19 | 128 | 272 | 77 | 476 | 1.7 | No |
| 20 | 176 | 327 | 111 | 587 | 1.6 | No |
| 21 | 160 | 307 | 89 | 522 | 1.8 | Yes |
| 22 | 237 | 396 | 153 | 721 | 1.5 | No |
| 23 | 125 | 263 | 69 | 449 | 1.8 | No |
| 24 | 218 | 376 | 139 | 679 | 1.6 | No |
| 25 | 177 | 330 | 106 | 578 | 1.7 | No |
| 26 | 144 | 288 | 65 | 447 | 2.2 | Yes |
| 27 | 201 | 357 | 100 | 576 | 2.0 | Yes |
| 28 | 122 | 261 | 58 | 417 | 2.1 | Yes |
| 29 | 163 | 316 | 66 | 462 | ***2.5*** | ***Yes*** |
| 30 | 149 | 299 | 84 | 510 | 1.8 | No |
| OL0422 | 1 | 173 | 325 | 97 | 551 | 1.8 | Yes |
| 2 | 198 | 354 | 109 | 597 | 1.8 | No |
| 3 | 166 | 316 | 86 | 524 | 1.9 | Yes |
| 4 | 65 | 181 | 30 | 297 | 2.2 | Yes |
| 5 | 197 | 347 | 111 | 592 | 1.8 | Yes |
| 6 | 205 | 362 | 104 | 587 | 2.0 | No |
| 7 | 236 | 398 | 138 | 690 | 1.7 | No |
| 8 | 101 | 233 | 47 | 372 | 2.1 | No |
| 9 | 202 | 353 | 117 | 613 | 1.7 | No |
| 10 | 189 | 340 | 112 | 595 | 1.7 | No |
| 11 | 213 | 369 | 129 | 650 | 1.7 | No |
| 12 | 153 | 299 | 81 | 498 | 1.9 | No |
| 13 | 164 | 313 | 84 | 515 | 2.0 | No |
| 14 | 166 | 316 | 90 | 535 | 1.8 | Yes |
| 15 | 202 | 361 | 89 | 547 | 2.3 | Yes |
| 16 | 239 | 402 | 140 | 694 | 1.7 | Yes |
| 17 | 209 | 367 | 121 | 632 | 1.7 | No |
| 18 | 158 | 307 | 76 | 489 | 2.1 | Yes |
| 19 | 233 | 397 | 130 | 669 | 1.8 | No |
| 20 | 205 | 364 | 113 | 609 | 1.8 | No |
| 21 | 142 | 286 | 75 | 477 | 1.9 | Yes |
| 22 | 153 | 298 | 85 | 508 | 1.8 | No |
| 23 | 189 | 341 | 112 | 596 | 1.7 | No |
| 24 | 212 | 368 | 126 | 641 | 1.7 | No |
| 25 | 183 | 335 | 110 | 590 | 1.7 | No |
| 26 | 67 | 185 | 36 | 311 | 1.9 | Yes |
| 27 | 178 | 329 | 101 | 563 | 1.8 | Yes |
| 28 | 141 | 284 | 61 | 436 | 2.3 | Yes |
| 29 | 137 | 279 | 75 | 471 | 1.8 | Yes |
| 30 | 207 | 365 | 130 | 651 | 1.6 | No |
| OL0364 | 1 | 212 | 376 | 119 | 636 | 1.8 | Yes |
| 2 | 132 | 272 | 76 | 471 | 1.7 | No |
| 3 | 142 | 288 | 85 | 506 | 1.7 | Yes |
| 4 | 311 | 372 | 134 | 666 | 2.3 | Yes |
| 5 | 191 | 352 | 108 | 597 | 1.8 | Yes |
| 6 | 128 | 271 | 68 | 454 | 1.9 | No |
| 7 | 74 | 194 | 37 | 322 | 2.0 | No |
| 8 | 168 | 320 | 100 | 558 | 1.7 | No |
| 9 | 178 | 332 | 110 | 591 | 1.6 | No |
| 10 | 214 | 369 | 140 | 672 | 1.5 | No |
| 11 | 215 | 375 | 140 | 680 | 1.5 | No |
| 12 | 188 | 342 | 115 | 606 | 1.6 | No |
| 13 | 184 | 337 | 98 | 563 | 1.9 | No |
| 14 | 223 | 389 | 136 | 679 | 1.6 | Yes |
| 15 | 183 | 341 | 90 | 546 | 2.0 | Yes |
| 16 | 216 | 379 | 125 | 652 | 1.7 | Yes |
| 17 | 227 | 391 | 144 | 701 | 1.6 | No |
| 18 | 183 | 336 | 102 | 570 | 1.8 | Yes |
| 19 | 174 | 327 | 107 | 579 | 1.6 | No |
| 20 | 202 | 365 | 104 | 594 | 1.9 | No |
| 21 | 89 | 216 | 40 | 340 | 2.2 | Yes |
| 22 | 191 | 346 | 120 | 621 | 1.6 | No |
| 23 | 207 | 367 | 128 | 653 | 1.6 | No |
| 24 | 201 | 357 | 125 | 636 | 1.6 | No |
| 25 | 178 | 329 | 103 | 571 | 1.7 | No |
| 26 | 160 | 309 | 88 | 520 | 1.8 | Yes |
| 27 | 149 | 295 | 78 | 492 | 1.9 | Yes |
| 28 | 221 | 387 | 145 | 699 | 1.5 | Yes |
| 29 | 143 | 291 | 72 | 476 | 2.0 | Yes |
| 30 | 222 | 388 | 132 | 669 | 1.7 | No |

**Supplementary table 2**: Ca, P, and Ca/P data from the surfaces of twenty-five skeletal elements from each of three modern humans, measured by scanning specimens with hXRF from the UC Anthropology Department’s Comparative Osteology teaching collection. Locations with Ca/P values higher than 2.3 are bolded and italicized. OL0364 is a subadult; all other individuals are adults.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Specimen | Element | Ca (x1000, ppm) | Ca error (ppm; ±2 s.d.) | P (x1000, ppm) | P error (ppm; ±2 s.d.) | Ca/P |
| OL0365 | calcaneus | 204 | 360 | 129 | 646 | 1.6 |
| carpal | 202 | 356 | 117 | 614 | 1.7 |
| cervical vertebra | 155 | 301 | 91 | 521 | 1.7 |
| clavicle | 197 | 352 | 112 | 602 | 1.8 |
| femur | 153 | 300 | 87 | 511 | 1.8 |
| fibula | 241 | 402 | 161 | 739 | 1.5 |
| humerus | 213 | 370 | 127 | 647 | 1.7 |
| lumbar vertebra | 169 | 320 | 98 | 548 | 1.7 |
| mandible | 215 | 372 | 139 | 676 | 1.5 |
| metacarpal | 105 | 237 | 59 | 405 | 1.8 |
| metatarsal | 187 | 340 | 112 | 592 | 1.7 |
| innominate | 90 | 218 | 43 | 350 | 2.1 |
| phalanx (hand) | 201 | 354 | 127 | 639 | 1.6 |
| phalanx(foot) | 112 | 247 | 64 | 425 | 1.8 |
| radius | 225 | 384 | 141 | 686 | 1.6 |
| rib | 233 | 394 | 143 | 693 | 1.6 |
| sacral vertebra | 124 | 263 | 67 | 443 | 1.9 |
| scapula | 184 | 337 | 111 | 590 | 1.7 |
| cranium | 48 | 151 | 24 | 248 | 2.0 |
| sternum | 121 | 258 | 67 | 440 | 1.8 |
| talus | 185 | 339 | 103 | 573 | 1.8 |
| tarsal | 185 | 336 | 112 | 592 | 1.7 |
| tibia | 206 | 363 | 120 | 627 | 1.7 |
| thoracic vertebra | 138 | 281 | 81 | 488 | 1.7 |
| ulna | 176 | 325 | 104 | 569 | 1.7 |
| OL0375 | calcaneus | 173 | 323 | 99 | 551 | 1.7 |
| carpal | 223 | 380 | 134 | 669 | 1.7 |
| cervical vertebra | 117 | 253 | 63 | 426 | 1.9 |
| clavicle | 172 | 321 | 98 | 550 | 1.8 |
| femur | 205 | 363 | 110 | 603 | 1.9 |
| fibula | 228 | 387 | 139 | 682 | 1.6 |
| humerus | 229 | 389 | 138 | 682 | 1.7 |
| lumbar vertebra | 175 | 325 | 101 | 563 | 1.7 |
| mandible | 179 | 329 | 108 | 579 | 1.7 |
| metacarpal | 205 | 357 | 131 | 645 | 1.6 |
| metatarsal | 139 | 281 | 76 | 471 | 1.8 |
| innominate | 96 | 225 | 46 | 362 | 2.1 |
| phalanx (hand) | 196 | 350 | 110 | 593 | 1.8 |
| phalanx(foot) | 214 | 370 | 136 | 665 | 1.6 |
| radius | 203 | 357 | 122 | 629 | 1.7 |
| rib | 200 | 355 | 118 | 613 | 1.7 |
| sacral vertebra | 138 | 281 | 69 | 456 | 2.0 |
| scapula | 224 | 382 | 138 | 676 | 1.6 |
| cranium | 183 | 335 | 106 | 578 | 1.7 |
| sternum | 174 | 324 | 101 | 558 | 1.7 |
| talus | 168 | 317 | 88 | 522 | 1.9 |
| tarsal | 116 | 251 | 60 | 414 | 1.9 |
| tibia | 174 | 323 | 101 | 558 | 1.7 |
| thoracic vertebra | 130 | 270 | 72 | 458 | 1.8 |
| ulna | 215 | 373 | 131 | 659 | 1.6 |
| OL0421 | calcaneus | 148 | 292 | 90 | 520 | 1.6 |
| carpal | 172 | 322 | 121 | 610 | 1.4 |
| cervical vertebra | 85 | 210 | 50 | 369 | 1.7 |
| clavicle | 160 | 309 | 98 | 547 | 1.6 |
| femur | 161 | 310 | 92 | 531 | 1.8 |
| fibula | 211 | 369 | 135 | 666 | 1.6 |
| humerus | 209 | 360 | 135 | 654 | 1.5 |
| mandible | 199 | 349 | 131 | 641 | 1.5 |
| metacarpal | 236 | 397 | 173 | 763 | 1.4 |
| metatarsal | 196 | 350 | 132 | 647 | 1.5 |
| innominate | 94 | 224 | 50 | 372 | 1.9 |
| phalanx | 213 | 371 | 159 | 719 | 1.3 |
| phalanx (hand) | 162 | 310 | 114 | 586 | 1.4 |
| radius | 208 | 364 | 129 | 650 | 1.6 |
| rib | 180 | 327 | 116 | 594 | 1.6 |
| sacral vertebra | 52 | 161 | 26 | 263 | 2.0 |
| scapula | 99 | 231 | 58 | 402 | 1.7 |
| cranium | 65 | 181 | 27 | 275 | ***2.4*** |
| sternum | 176 | 322 | 108 | 571 | 1.6 |
| talus | 135 | 278 | 52 | 402 | ***2.6*** |
| tarsal | 192 | 344 | 113 | 600 | 1.7 |
| tibia | 157 | 303 | 94 | 532 | 1.7 |
| thoracic vertebra | 121 | 259 | 76 | 467 | 1.6 |
| ulna | 224 | 383 | 143 | 692 | 1.6 |

**Supplementary table 3**: Ca, P, and Ca/P data for the surfaces of 59 elements from a variety of modern animals, measured by scanning specimens with hXRF from the UC Anthropology Department’s Comparative Osteology and Zooarcheology teaching collections.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Specimen | Order | Genus/Species | Element | Ca (x1000, ppm) | Ca error (ppm; ±2 s.d.) | P (x1000, ppm) | P error (ppm; ±2 s.d.) | Ca/P |
| OL0333C | Primates | *Homo sapiens* | femur | 149 | 289 | 90 | 509 | 1.7 |
| OL0340Ai | Primates | *Homo sapiens* | femur | 182 | 335 | 88 | 533 | 2.1 |
| OL0365 | Primates | *Homo sapiens* | femur | 99 | 231 | 40 | 349 | 2.5 |
| OL0375 | Primates | *Homo sapiens* | femur | 205 | 363 | 110 | 603 | 1.9 |
| OL0420Bii | Primates | *Homo sapiens* | femur | 221 | 382 | 131 | 663 | 1.7 |
| OL0421 | Primates | *Homo sapiens* | femur | 161 | 310 | 92 | 531 | 1.8 |
| OL0422Lii | Primates | *Homo sapiens* | femur | 173 | 325 | 97 | 551 | 1.8 |
| OL0864616 | Primates | *Homo sapiens* | femur | 212 | 376 | 119 | 636 | 1.8 |
| OL0301 | Primates | *Pan troglodytes* | humerus | 221 | 375 | 120 | 630 | 1.8 |
| OL0049 | Primates | *Pan troglodytes* | cranium | 74 | 195 | 38 | 323 | 1.9 |
| OL0045 | Primates | *Pan troglodytes* | cranium | 48 | 153 | 21 | 240 | 2.3 |
| OL0046 | Primates | *Pan troglodytes* | cranium | 170 | 322 | 103 | 567 | 1.7 |
| OL0028 | Primates | *Macaca* sp. | cranium | 219 | 375 | 102 | 585 | 2.1 |
| OL032a | Primates | *Papio* sp. | cranium | 227 | 389 | 142 | 705 | 1.6 |
| OL0026 | Primates | *Macaca* sp. | cranium | 245 | 409 | 155 | 731 | 1.6 |
| OL0029 | Primates | *Macaca* sp. | cranium | 236 | 393 | 122 | 648 | 1.9 |
| OL0030a | Primates | *Macaca* sp. | cranium | 241 | 405 | 159 | 737 | 1.5 |
| OL0284 | Primates | *Macaca* sp*.* | cranium | 224 | 382 | 159 | 726 | 1.4 |
| OL02686 | Primates | *Macaca* sp. | humerus | 189 | 345 | 113 | 604 | 1.7 |
| OL0282 | Primates | *Macacca* sp*.* | cranium | 245 | 412 | 157 | 736 | 1.6 |
| OL0272 | Primates | *Macaca* sp*.* | cranium | 156 | 331 | 99 | 599 | 1.6 |
| OL0282 | Primates | *Macaca* sp.  | cranium | 232 | 398 | 147 | 709 | 1.6 |
| OL0269 | Primates | *Papio hamadryas* | femur | 211 | 364 | 139 | 668 | 1.5 |
| OL0273 | Primates | *Papio hamadryas* | tibia | 140 | 294 | 86 | 521 | 1.6 |
| OL0265 | Primates | *Papio hamadryas* | innominate | 220 | 375 | 142 | 684 | 1.5 |
| OL0266 | Primates | *Cercopithecus* sp. | scapula | 161 | 306 | 94 | 534 | 1.7 |
| OL0274 | Primates | *Cercopithecus* sp. | scapula | 188 | 339 | 122 | 620 | 1.5 |
| OL0270 | Primates | *Saimiri* sp. | cranium | 244 | 403 | 171 | 762 | 1.4 |
| OL0270 | Primates | *Saimiri* sp*.*  | scapula | 178 | 326 | 115 | 594 | 1.5 |
| ZA31 | Rodentia | *Castor canadensis* | cranium | 130 | 269 | 87 | 498 | 1.5 |
| ZA115 | Rodentia | *Mus* sp. | cranium | 90 | 217 | 51 | 380 | 1.8 |
| ZA116 | Rodentia | *Mus* sp. | cranium | 168 | 317 | 86 | 522 | 2.0 |
| ZA27 | Carnivora | *Neogale vison* | scapula | 207 | 359 | 138 | 664 | 1.5 |
| ZA9 | Canivora | *Lynx rufus* | cranium | 235 | 393 | 146 | 701 | 1.6 |
| ZA1 | Carnivora | *Felis catus* | cranium | 254 | 411 | 126 | 663 | 2.0 |
| ZA4 | Carnivora | *Felis catus* | cranium | 259 | 414 | 155 | 727 | 1.7 |
| ZA5 | Carnivora | *Felis catus* | innominate | 151 | 293 | 75 | 475 | 2.0 |
| ZA3 | Carnivora | *Felis catus* | scapula | 201 | 351 | 111 | 595 | 1.8 |
| ZA2 | Carnivora | *Felis catus* | scapula | 214 | 364 | 138 | 661 | 1.6 |
| ZA62 | Carnivora | *Vulpes vulpes* | mandible | 188 | 334 | 124 | 614 | 1.5 |
| ZA21 | Carnivora | *Procyon lotor* | mandible | 147 | 293 | 89 | 522 | 1.7 |
| ZA53 | Carnivora | *Procyon lotor* | mandible | 184 | 334 | 115 | 598 | 1.6 |
| ZA40 | Carnivora | *Procyon lotor* | cranium | 72 | 192 | 34 | 308 | 2.1 |
| ZA56 | Carnivora | *Procyon lotor* | scapula | 144 | 285 | 99 | 536 | 1.5 |
| ZA118 | Carnivora | *Canis familiaris* | cranium | 214 | 369 | 121 | 636 | 1.8 |
| ZA112 | Carnivora | *Canis latrans* | cranium | 161 | 308 | 96 | 546 | 1.7 |
| ZA150 | Carnivora | *Canis latrans* | tibia | 193 | 346 | 120 | 624 | 1.6 |
| ZA28 | Carnivora | *Lontra canadensis* | cranium | 180 | 328 | 120 | 608 | 1.5 |
| ZA81 | Artiodactyla | *Bison bison* | scapula | 187 | 337 | 121 | 614 | 1.5 |
| ZA80 | Artiodactyla | *Bison bison* | scapula | 82 | 206 | 45 | 352 | 1.8 |
| ZA75 | Artiodactyla | *Odocoileus hemionus* | sacrum | 200 | 356 | 116 | 627 | 1.7 |
| ZA16 | Artiodactyla | *Bos taurus* | tibia | 225 | 383 | 136 | 683 | 1.7 |
| ZA131 | Artiodactyla | *Capra hircus* | femur | 213 | 368 | 132 | 660 | 1.6 |
| ZA(no number) | Artiodactyla | *Bos taurus* | mandible | 63 | 177 | 33 | 299 | 1.9 |
| ZA186 | Macropoda | *Thylogale* sp. | femur | 178 | 327 | 116 | 597 | 1.5 |
| ZA156 | Didelphimorphia | *Didelphis virginina* | cranium | 120 | 255 | 72 | 451 | 1.7 |
| ZA171 | Didelphimorphia | *Didelphis virginina* | mandible | 104 | 234 | 67 | 428 | 1.6 |
| ZA69 | Testudines |  | plastron | 214 | 369 | 119 | 631 | 1.8 |
| ZA210 | Crocodilia | *Alligator missippiensis* | cranium | 202 | 358 | 114 | 620 | 1.8 |

**Supplementary table 4:** Peaks measured from FTIR spectra used to characterize CO3/PO4 in untreated enamel samples.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Specimen | Genus | Tooth |  Carbonate Peaks at 1400 nm-1 and 1500 nm-1 | Phosphate peak at 1000 nm-1 | Phosphate peak at 600 nm-1 |
| 2022-1950-59a | *Bison* | M1 | 26 |  | 55 |  | 34 |  |
| 2022-1950-59b | *Bison* | M2 | 35 |  | 60 |  | 44 |  |
| 2022-1950-59c | *Bison* | M3 | 35 |  | 60 |  | 43 |  |
| 2022-1950-49 | *Bison* | M2 | 14 |  | 62 |  | 43 |  |
| 2022-1950-57a | *Bison* | M1 | 22 |  | 64 |  | 4 |  |
| 2022-1950-57b | *Bison* | M2 | 28 |  | 73 |  | 32 |  |
| 2022-1950-57c | *Bison* | M3 | 34 |  | 60 |  | 44 |  |
| 2022-1950-58a | *Bison* | M1 | 13 |  | 50 |  | 32 |  |
| 2022-1950-58b | *Bison* | M2 | 30 |  | 47 |  | 33 |  |
| 2022-1950-58c | *Bison* | M3 | 37 |  | 69 |  | 48 |  |
| 2022-1950-21a | *Bison* | M1 | 21 |  | 60 |  | 50 |  |
| 2022-1950-21b | *Bison* | M2 | 42 |  | 71 |  | 50 |  |
| 2022-1950-55 | *Equus* |  | 19 |  | 60 |  | 41 |  |
| 2022-1950-23 | *Equus* |  | 32 |  | 57 |  | 42 |  |
| 2022-1950-27 | *Mammut* |  | 14 |  | 63 |  | 42 |  |
| 2022-1950-05 | *Mammuthus* |  | 31 |  | 44 |  | 30 |  |
| 2022-1950-29 | *Mammuthus* |  | 9 |  | 50 |  | 21 |  |
| 2022-1950-09 | *Mammuthus* |  | 25 |  | 63 |  | 42 |  |
| 2022-1950-10 | *Mammuthus* |  | 30 |  | 52 |  | 37 |  |
| 2022-1950-08 | *Mammuthus* |  | 12 |  | 61 |  | 42 |  |

**Supplementary table 5**: Ca/Psurface data collected with hXRF for the surfaces of mandibles and associated teeth for eight modern animals from the UC Anthropology Department’s Comparative Osteology and Zooarchaeology teaching collections.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Specimen Number | Order | Individual | Mandible | Incisor | p2 | p3 | p4 | m1 | m2 | m3 | Tooth |
| OL0282 | Primates | *Macaca sp.* | 1.6 | 1.5 |  |  | 1.1 |  |  |  |  |
| OL0301 | Primates | *Pan troglodytes* | 2.3 |  |  |  |  | 2.1 |  |  |  |
| ZA31 | Rodentia | *Castor canadensis* | 1.5 | 1.6 |  |  |  |  |  |  |  |
| ZA118 | Carnivora | *Canis familiaris* | 1.6 |  |  |  |  | 1.7 |  |  |  |
| ZA176 | Artiodactyla | *Sus scrofa* | 1.9 |  |  |  | 1.8 | 1.7 | 1.7 | 1.7 |  |
| ZA87 | Artiodactyla | *Bos taurus* | 1.6 |  |  |  |  | 1.5 | 1.7 | 1.6 |  |
| ZA84 | Artiodactyla | *Bos taurus* | 1.6 |  | 1.7 | 2.0 | 2.0 | 1.6 | 2.1 | 1.8 |  |
| ZA210 | Crocodilia | *Alligator mississippiensis* | 1.8 |  |  |  |  |  |  |  | 1.5, 1.7 |

