

Supplementary online material for:

“Deglacial intermediate water reorganization: new evidence from the Indian Ocean” Sarah Romahn, Andreas Mackensen, Jeroen Groeneveld, Jürgen Pätzold

Table S1: AMS radiocarbon analyses details.

Measured ^{14}C radiocarbon ages were converted into calibrated ages before present (BP) by applying a reservoir age correction of $\Delta R = 140$ yrs (Southon et al., 2002) using the Calib 6.0 software (Stuiver et al., 2005), based on the Marine09 calibration curve. A was applied to the ca

| Label | Core depth (cm) | Planktic foraminifera species | measured ^{14}C AMS age (yr) | error (yr) | calibrated Calendar age (yr BP) | error (yr) (1σ) |
|-----------|-----------------|---|---------------------------------------|--------------|---------------------------------|--------------------------|
| KIA 46245 | 20 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 1375 | ± 25 | 766 | ± 39 |
| KIA 43717 | 88 | <i>G. sacculifer, G. aequilateralis, G. conglobatus</i> | 2555 | +35 / -30 | 2049 | ± 53 |
| KIA 43716 | 112 | <i>G. sacculifer, G. aequilateralis, G. conglobatus</i> | 3175 | ± 35 | 2794 | ± 42 |
| KIA 43715 | 160 | <i>G. sacculifer, G. aequilateralis, G. conglobatus</i> | 3995 | ± 30 | 3814 | ± 55 |
| KIA 44976 | 272 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 6225 | ± 35 | 6505 | ± 55 |
| KIA 43714 | 308 | <i>G. sacculifer, G. aequilateralis, G. conglobatus</i> | 7820 | ± 45 | 8128 | ± 66 |
| KIA 46244 | 344 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 8305 | ± 40 | 8645 | ± 68 |
| KIA 44977 | 420 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 9795 | ± 50 | 10526 | ± 45 |
| KIA 44978 | 444 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 10520 | ± 55 | 11552 | ± 51 |
| KIA 46243 | 461 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 11685 | ± 55 | 13032 | ± 87 |
| KIA 44979 | 468 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 12590 | ± 60 | 13895 | ± 77 |
| KIA 46242 | 488 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 13980 | ± 70 | 16626 | ± 151 |
| KIA 43713 | 500 | <i>G. sacculifer, G. aequilateralis, G. conglobatus</i> | 15700 | + 130 / -120 | 18195 | ± 112 |
| KIA 44424 | 504 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 15710 | ± 80 | 18201 | ± 86 |
| KIA 46241 | 524 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 21090 | ± 140 | 24558 | ± 225 |
| KIA 44980 | 572 | <i>G.ruber, G. sacculifer, G. aequilateralis</i> | 34460 | +770 / -700 | 38790 | ± 165 |

Figure S1: salinity profile from CTD station GeoB12616-6,

The CTD profile was measured during the Meteor Cruise No. M75 on 16 February 2008 at 06°57.62S 40°23.66E in the western Indian Ocean (Savoie et al., 2013). SAMW: Subantarctic Mode Water; AAIW: Antarctic Intermediate Water; RSW: Red Sea Water.

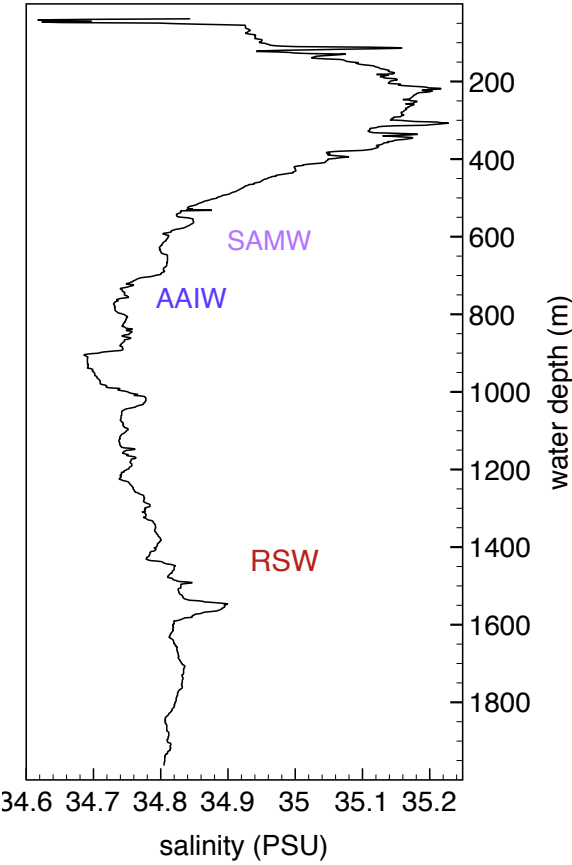


Figure S2: Linear Sedimentation Rate

The sedimentation rate varies strongly between the Holocene (average of 46 cm/kyr, highest between ~ 8.7 and 8.2 kyr with 70 cm/kyr) and the glacial (below 10 cm/kyr).

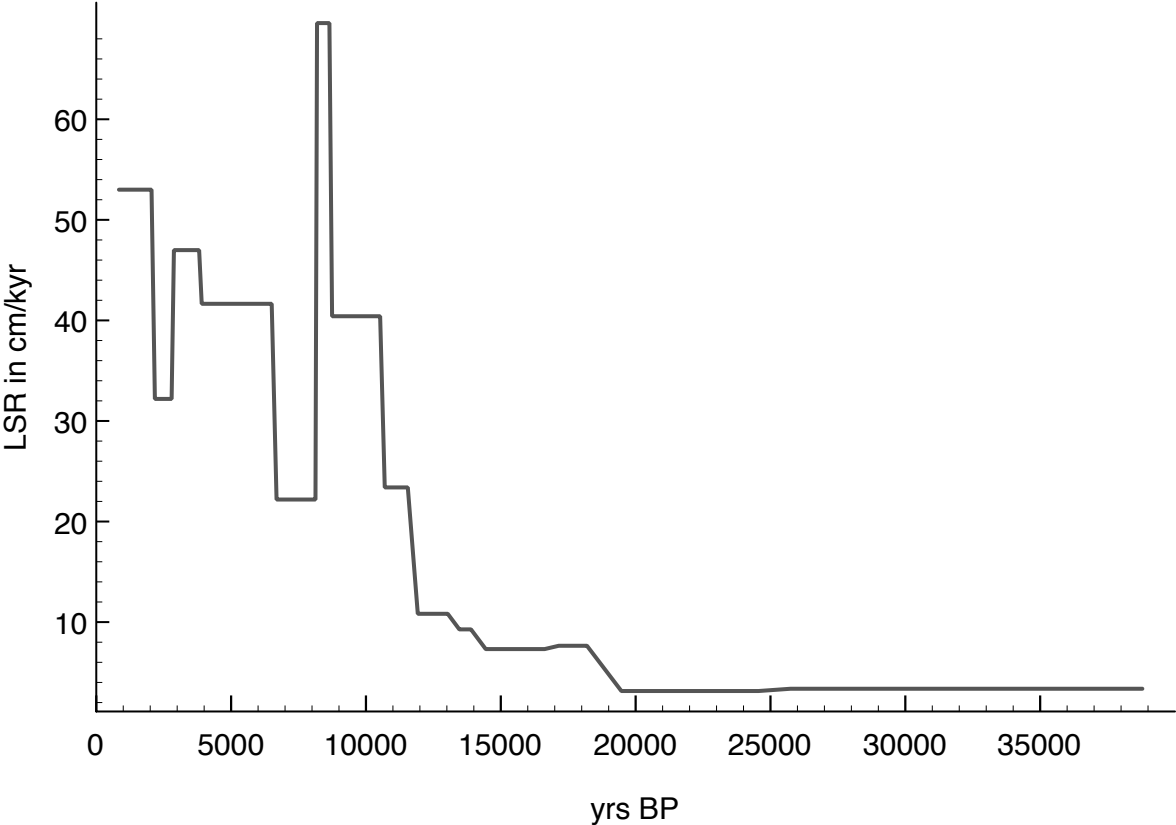


Figure S3: additional duplicate $\delta^{18}\text{O}$ analyses

We performed additional duplicate measurements for the core section representing the deglacial to validate the record. We calculated an average $\delta^{18}\text{O}$ value for each sampling point. Figure S3 shows the individual measurements (crosses) as well as the calculated average data (open circles).

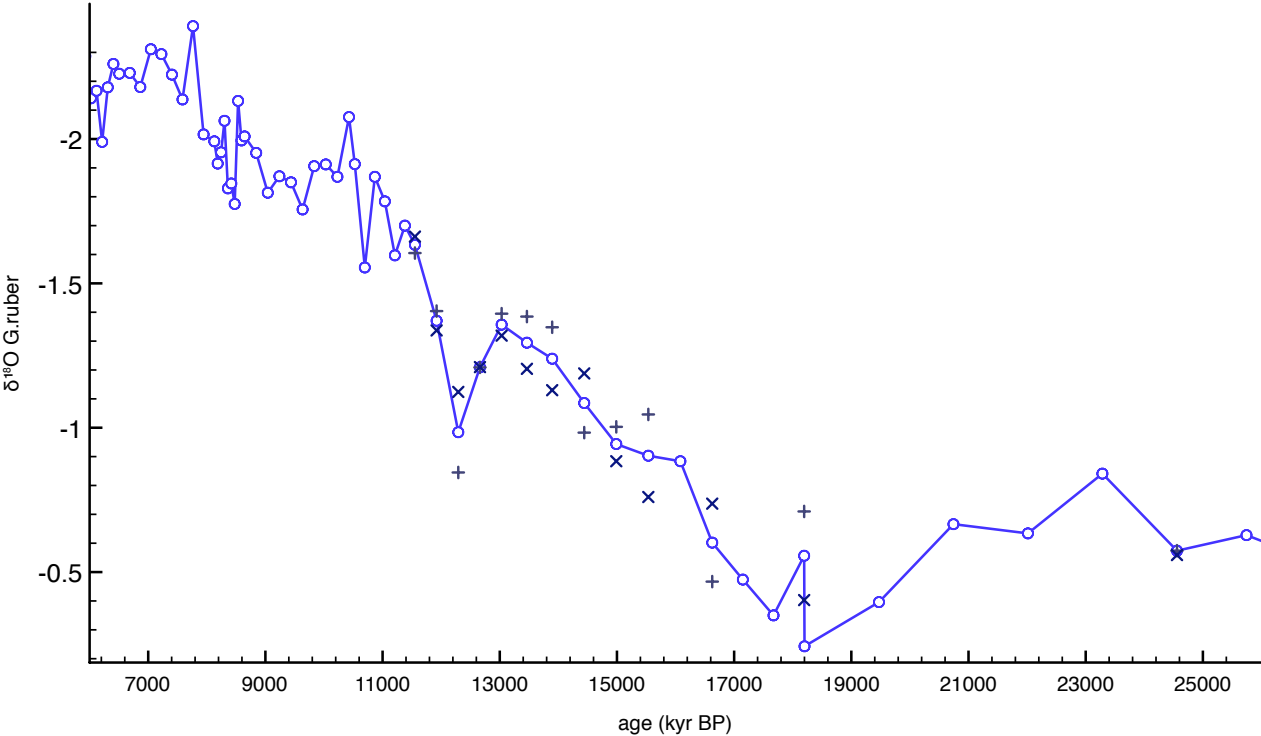


Table S2: uppermost core samples SST based on Mg/Ca.

SST (T in °C) were calculated using the equation given by Anand et al. (2003):

$$\text{Mg/Ca (mmol/mol)} = 0.38 \exp(0.090 T)$$

with with a standard deviation of $\pm 1.1 - 1.4^\circ\text{C}$ (Dekens et al., 2002; Anand et al., 2003).

| Core depth(cm) | calibrated age (yr BP) | SST in °C |
|----------------|------------------------|-----------|
| 4 | younger than 766 | 30.0 |
| 8 | younger than 766 | 28.4 |
| 20 | 766 | 28.6 |
| 28 | 917 | 29.1 |

Generally, the core top of sediment records with average sedimentation rate is used to represent modern values. But for GeoB12615-4, the AMS radiocarbon analysis of the 20 cm sample and the resulting age model suggest a very high sedimentation rate in the uppermost section of the core. Therefore we consider the uppermost 28 cm of the sediment record (not older than ~1000 yrs BP) to be representative for modern conditions, analogue to core top data in other records.

Table S3: stable isotope and Mg/Ca ratios of core GeoB12615-4

| core depth (cm) | age (kyr BP) | $\delta^{18}\text{O}$ <i>P. ariminensis</i> (‰VPDB) | $\delta^{13}\text{C}$ <i>P. ariminensis</i> (‰VPDB) | $\delta^{18}\text{O}$ <i>G. ruber</i> (‰VPDB) | $\delta^{13}\text{C}$ <i>G. ruber</i> (‰VPDB) | Mg/Ca (mmol/mol) | SST (°C) |
|-----------------|--------------|---|---|---|---|---------------------|----------|
| 4 | | | | -2.26 | 1.50 | 5.63 | 30.0 |
| 8 | | | | -2.25 | 1.35 | 4.90 | 28.4 |
| 12 | | | | -2.14 | 1.66 | | |
| 16 | | | | -2.13 | 1.26 | | |
| 20 | 766 | 1.03 | 1.49 | -1.97 | 1.22 | 4.99 | 28.6 |
| 24 | 841 | 0.99 | 1.52 | -2.12 | 1.39 | | |
| 28 | 917 | 0.96 | 1.47 | -1.99 | 1.21 | 5.24 | 29.1 |
| 32 | 992 | 1.01 | 1.51 | -2.12 | 1.16 | | |
| 36 | 1068 | 1.02 | 1.43 | -2.01 | 1.57 | 4.93 | 28.5 |
| 40 | 1143 | 1.05 | 1.45 | -2.05 | 1.28 | | |
| 44 | 1219 | 1.09 | 1.46 | -1.89 | 1.18 | 5.00 | 28.6 |
| 48 | 1294 | 1.04 | 1.44 | -2.05 | 1.36 | | |
| 52 | 1370 | 1.05 | 1.46 | -2.04 | 1.17 | 5.30 | 29.3 |
| 56 | 1445 | 1.09 | 1.43 | -1.89 | 1.46 | | |
| 60 | 1521 | 1.02 | 1.37 | -2.31 | 1.27 | 4.82 | 28.2 |
| 64 | 1596 | 1.03 | 1.44 | -2.15 | 1.26 | | |
| 68 | 1672 | 1.04 | 1.44 | | | 4.94 | 28.5 |
| 72 | 1747 | 1.04 | 1.48 | -2.02 | 1.29 | | |
| 76 | 1823 | 0.96 | 1.49 | -2.10 | 1.37 | 4.70 | 28.0 |
| 80 | 1898 | 0.98 | 1.42 | | | | |
| 84 | 1974 | 1.06 | 1.49 | -2.08 | 1.31 | 4.79 | 28.1 |
| 88 | 2049 | 0.99 | 1.46 | -2.18 | 1.39 | | |
| 92 | 2173 | 1.06 | 1.50 | -2.30 | 1.28 | 5.19 | 29.0 |
| 96 | 2297 | 0.97 | 1.45 | -2.37 | 1.35 | | |
| 100 | 2422 | 0.95 | 1.42 | -2.21 | 1.21 | 4.73 | 28.0 |
| 104 | 2546 | 1.04 | 1.45 | -1.99 | 1.59 | | |
| 108 | 2670 | 0.96 | 1.46 | -2.28 | 1.26 | 4.62 | 27.8 |
| 112 | 2794 | 1.09 | 1.47 | -2.08 | 1.39 | 4.75 | 28.1 |
| 116 | 2879 | 1.02 | 1.53 | -2.06 | 1.44 | | |
| 120 | 2964 | 0.88 | 1.31 | -2.17 | 1.11 | 4.81 | 28.2 |
| 124 | 3049 | 1.01 | 1.31 | -1.99 | 1.34 | | |
| 128 | 3134 | 1.00 | 1.43 | -2.06 | 1.47 | 4.66 | 27.8 |
| 132 | 3219 | 1.06 | 1.43 | | | | |
| 136 | 3304 | 0.95 | 1.43 | -2.11 | 1.45 | | |
| 140 | 3389 | 1.07 | 1.45 | -2.31 | 1.25 | | |
| 144 | 3474 | 1.03 | 1.41 | -2.09 | 1.46 | 4.73 | 28.7 |
| 148 | 3559 | 0.99 | 1.48 | -2.23 | 1.46 | | |
| 152 | 3644 | 0.96 | 1.38 | -2.41 | 1.29 | 4.77 | 28.1 |
| 156 | 3729 | 1.11 | 1.46 | | | | |

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|-----|------|------|------|-------|------|------|------|
| 160 | 3814 | 1.08 | 1.48 | -2.16 | 1.47 | 4.85 | 28.3 |
| 164 | 3910 | 1.13 | 1.51 | -2.07 | 1.51 | | |
| 168 | 4006 | 1.02 | 1.48 | -2.26 | 1.65 | 4.83 | 28.3 |
| 172 | 4102 | 1.14 | 1.46 | -2.20 | 1.32 | | |
| 176 | 4198 | 1.10 | 1.47 | -2.10 | 1.39 | 4.49 | 27.4 |
| 180 | 4294 | 1.06 | 1.39 | -2.21 | 1.46 | | |
| 184 | 4390 | 1.11 | 1.41 | -2.17 | 1.58 | 4.90 | 28.4 |
| 188 | 4486 | 1.17 | 1.32 | -2.27 | 1.14 | | |
| 192 | 4582 | | | -2.35 | 1.48 | 4.59 | 27.7 |
| 196 | 4678 | 1.05 | 1.50 | -2.15 | 1.54 | | |
| 200 | 4774 | 1.22 | 1.49 | -2.21 | 1.40 | 4.88 | 28.4 |
| 204 | 4870 | 1.14 | 1.45 | -2.17 | 1.60 | | |
| 208 | 4966 | | | -2.16 | 1.61 | 4.67 | 27.9 |
| 212 | 5062 | 1.03 | 1.45 | -2.13 | 1.01 | | |
| 216 | 5158 | 1.09 | 1.50 | -2.22 | 1.24 | 4.73 | 28.0 |
| 220 | 5254 | 1.07 | 1.44 | -2.00 | 1.30 | | |
| 224 | 5350 | 1.00 | 1.46 | -1.98 | 1.42 | 4.59 | 27.7 |
| 228 | 5446 | 1.11 | 1.43 | -2.06 | 1.44 | | |
| 232 | 5542 | 1.07 | 1.41 | -2.09 | 1.42 | 4.66 | 27.9 |
| 236 | 5638 | 1.11 | 1.48 | -2.02 | 1.15 | | |
| 240 | 5734 | 1.09 | 1.42 | -2.06 | 1.30 | 4.81 | 28.2 |
| 244 | 5830 | 1.08 | 1.40 | -2.07 | 1.49 | | |
| 248 | 5926 | 1.10 | 1.30 | -2.29 | 1.23 | 5.04 | 28.7 |
| 252 | 6022 | 1.14 | 1.43 | -2.14 | 1.12 | | |
| 256 | 6118 | 0.99 | 1.32 | -2.17 | 1.34 | 4.93 | 28.5 |
| 260 | 6214 | 0.97 | 1.34 | -1.99 | 1.39 | | |
| 264 | 6310 | 1.10 | 1.37 | -2.18 | 1.36 | 4.51 | 27.5 |
| 268 | 6406 | 1.01 | 1.45 | -2.26 | 1.23 | | |
| 272 | 6505 | 1.06 | 1.44 | -2.23 | 1.26 | 4.57 | 27.6 |
| 276 | 6685 | 1.03 | 1.41 | -2.23 | 1.18 | 4.38 | 27.2 |
| 280 | 6865 | 1.08 | 1.33 | -2.18 | 1.29 | 4.65 | 27.8 |
| 284 | 7045 | 1.07 | 1.43 | -2.31 | 1.36 | | |
| 288 | 7225 | 1.13 | 1.40 | -2.29 | 1.40 | 4.33 | 27.0 |
| 292 | 7405 | 1.08 | 1.36 | -2.22 | 1.43 | | |
| 296 | 7585 | 1.09 | 1.34 | -2.14 | 1.48 | 4.93 | 28.5 |
| 300 | 7765 | 1.10 | 1.31 | -2.39 | 1.08 | | |
| 304 | 7945 | 1.16 | 1.29 | -2.02 | 1.28 | 4.77 | 28.1 |
| 308 | 8128 | 1.16 | 1.26 | -1.99 | 1.35 | 4.72 | 28.3 |
| 312 | 8186 | 1.25 | 1.30 | -1.92 | 0.98 | 4.85 | 28.3 |
| 316 | 8244 | 1.27 | 1.23 | -1.95 | 1.12 | 4.82 | 28.2 |
| 320 | 8302 | 1.33 | 1.16 | -2.06 | 0.94 | 4.66 | 27.8 |
| 324 | 8360 | 1.28 | 1.17 | -1.83 | 0.86 | 4.77 | 28.1 |
| 328 | 8418 | 1.22 | 1.13 | -1.85 | 0.75 | 4.50 | 27.5 |
| 332 | 8476 | 1.20 | 1.12 | -1.78 | 0.57 | 4.56 | 27.6 |
| 336 | 8534 | | | -2.13 | 1.07 | 4.75 | 28.1 |
| 340 | 8592 | 1.30 | 1.12 | -2.00 | 0.81 | 4.56 | 27.6 |
| 344 | 8645 | 1.27 | 1.20 | -2.01 | 1.04 | 4.89 | 28.4 |

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|-----|-------|------|------|-------|------|------|------|
| 348 | 8744 | 1.31 | 1.15 | | | | |
| 352 | 8843 | 1.19 | 1.19 | -1.95 | 0.89 | 4.44 | 27.3 |
| 356 | 8942 | 1.28 | 1.21 | | | | |
| 361 | 9041 | 1.28 | 1.15 | -1.81 | 0.89 | 4.56 | 27.6 |
| 364 | 9140 | | | | | | |
| 368 | 9239 | 1.25 | 1.07 | -1.87 | 1.03 | 4.83 | 28.2 |
| 372 | 9338 | 1.29 | 1.16 | | | | |
| 376 | 9437 | | | -1.85 | 1.08 | 4.65 | 27.8 |
| 380 | 9536 | 1.36 | 1.19 | | | | |
| 384 | 9635 | 1.33 | 1.12 | -1.76 | 0.82 | 4.80 | 28.2 |
| 388 | 9734 | | | | | | |
| 392 | 9833 | 1.36 | | -1.91 | 0.90 | 4.38 | 27.2 |
| 396 | 9932 | | | | | | |
| 400 | 10031 | 1.32 | 1.17 | -1.91 | 1.02 | 4.64 | 27.8 |
| 404 | 10130 | 1.30 | 1.04 | | | | |
| 408 | 10229 | | | -1.87 | 0.92 | 4.66 | 27.9 |
| 412 | 10328 | | | | | | |
| 416 | 10427 | | | -2.08 | 0.59 | 4.84 | 28.3 |
| 420 | 10526 | 1.35 | 1.09 | -1.91 | 0.64 | | |
| 424 | 10697 | 1.39 | 0.95 | -1.56 | 0.87 | 4.90 | 28.4 |
| 428 | 10868 | 1.30 | 0.98 | -1.87 | 0.77 | 4.61 | 27.7 |
| 432 | 11039 | 1.40 | 1.02 | -1.78 | 0.93 | 4.70 | 27.9 |
| 436 | 11210 | 1.46 | 1.02 | -1.60 | 0.72 | 4.74 | 28.1 |
| 440 | 11381 | 1.49 | 1.00 | -1.70 | 0.69 | 4.68 | 27.9 |
| 444 | 11552 | 1.55 | 1.10 | -1.63 | 0.95 | 4.76 | 28.1 |
| 448 | 11922 | 1.56 | 1.12 | -1.37 | 0.97 | 4.58 | 27.7 |
| 452 | 12292 | 1.66 | 1.15 | -0.98 | 0.83 | 4.51 | 27.5 |
| 456 | 12662 | 1.71 | 1.16 | -1.21 | 0.89 | 4.36 | 27.1 |
| 461 | 13032 | 1.76 | 1.21 | -1.36 | 0.89 | 4.19 | 26.7 |
| 464 | 13463 | 1.84 | 1.21 | -1.29 | 0.88 | 4.29 | 26.9 |
| 468 | 13895 | 1.86 | 1.16 | -1.24 | 0.88 | 4.21 | 26.7 |
| 472 | 14442 | 1.89 | 1.15 | -1.09 | 0.79 | 4.37 | 27.1 |
| 476 | 14989 | 1.96 | 1.13 | -0.94 | 0.92 | 4.45 | 27.3 |
| 480 | 15536 | 1.91 | 1.16 | -0.90 | 0.95 | 4.32 | 27.0 |
| 484 | 16083 | 1.99 | 1.15 | -0.88 | 0.95 | 4.36 | 27.1 |
| 488 | 16626 | 2.20 | 1.27 | -0.60 | 0.88 | | |
| 492 | 17149 | 2.29 | 1.29 | -0.47 | 1.02 | 4.07 | 26.4 |
| 496 | 17672 | 2.44 | 1.46 | -0.35 | 0.85 | | |
| 500 | 18195 | 2.45 | 1.40 | -0.56 | 0.82 | 3.70 | 25.3 |
| 504 | 18201 | 2.49 | 1.48 | -0.24 | 0.84 | | |
| 508 | 19472 | 2.52 | 1.47 | -0.40 | 1.15 | 3.82 | 25.7 |
| 512 | 20743 | 2.32 | 1.53 | -0.67 | 1.02 | 3.63 | 25.1 |
| 516 | 22014 | 2.48 | 1.47 | -0.63 | 0.70 | 3.97 | 26.1 |
| 520 | 23285 | 2.46 | 1.52 | -0.84 | 1.11 | 3.95 | 26.0 |
| 524 | 24558 | 2.51 | 1.35 | -0.57 | 1.04 | 3.69 | 25.3 |
| 528 | 25744 | 2.64 | 1.37 | -0.63 | 0.91 | 3.88 | 25.8 |
| 532 | 26930 | 2.47 | 1.50 | -0.54 | 1.21 | 3.97 | 26.1 |

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|-----|-------|------|------|-------|------|------|------|
| 536 | 28116 | 2.43 | 1.58 | -0.51 | 0.99 | 3.78 | 25.5 |
| 540 | 29302 | 2.54 | 1.51 | -0.66 | 1.11 | 4.04 | 26.1 |
| 544 | 30488 | 2.51 | 1.55 | -0.74 | 1.08 | 3.78 | 25.5 |
| 548 | 31674 | 2.29 | 1.56 | -0.92 | 1.04 | 3.81 | 25.6 |
| 552 | 32860 | 2.28 | 1.49 | | | | |
| 556 | 34046 | 2.20 | 1.45 | -1.06 | 1.18 | 3.87 | 25.8 |
| 560 | 35232 | 2.34 | 1.53 | -0.95 | 0.91 | 3.83 | 25.7 |
| 564 | 36418 | 2.06 | 1.43 | -0.91 | 1.04 | 3.82 | 25.6 |
| 568 | 37604 | 2.03 | 1.33 | -1.14 | 1.01 | | |
| 572 | 38790 | | | | | 3.82 | 25.6 |

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