Supporting Information for

Estimating biogenic silica production of Rhizaria in the global ocean

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**Figure S1.** Linear and an exponential regressions using data from Tables S2 and S3. This figure shows the best fit analysis of living cells with depth for Polycystina (a) and Phaeodaria (b) in warm waters and for Polycystina (c) and Phaeodaria (d) in cold waters.
Table S1. Morphometric measurements (obtained for this study, including mostly small-sized Polycystina and larger Phaeodaria) added to the Biard et al. (2018) allometric relationship between cell size and Silica content. This new relationship encompasses a wider size spectrum than that covered by previous studies.

| ID             | Group       | Length (µm) | Biovolume (µm$^3$) | ESD (µm) | Silica (µg Si cell$^{-1}$) |
|----------------|-------------|-------------|--------------------|----------|---------------------------|
| MOOSEGE17      | Aulacantha  | 803         | 272991090.3        | 804.85   | 2.88                      |
| MOOSEGE17      | Aulacantha  | 901         | 382977266.7        | 901.00   | 1.56                      |
| MOOSEGE17      | Aulacantha  | 725         | 145324999.6        | 652.30   | 1.65                      |
| MOOSEGE17      | Aulacantha  | 981         | 494317111.5        | 981.00   | 2.38                      |
| MOOSEGE17      | Aulacantha  | 840         | 310339088.7        | 840.00   | 1.11                      |
| MOOSEGE17      | Aulacantha  | 1031        | 573818595.5        | 1031.00  | 2.01                      |
| MOOSEGE17      | Aulacantha  | 980         | 492806978.8        | 980.00   | 1.11                      |
| MOOSEGE17      | Aulacantha  | 958         | 460357422.2        | 958.00   | 1.13                      |
| MOOSEGE17      | Aulacantha  | 760         | 172412053.8        | 690.54   | 1.09                      |
| MOOSEGE17      | Aulacantha  | 760         | 172412053.8        | 690.54   | 0.63                      |
| MOOSEGE17      | Aulacantha  | 921         | 409984710.4        | 921.70   | 1.69                      |
| MOOSEGE17      | Aulacantha  | 834         | 311525152.9        | 841.07   | 1.65                      |
| MOOSEGE17      | Aulacantha  | 834         | 311525152.9        | 841.07   | 1.45                      |
| MOOSEGE17      | Aulacantha  | 834         | 311525152.9        | 841.07   | 2.12                      |
| MOOSEGE17      | Aulacantha  | 834         | 311525152.9        | 841.07   | 1.77                      |
| MOOSEGE17      | Collodaria  | 190         | 4222516.662        | 200.54   | 0.11                      |
| MOOSEGE17      | Collodaria  | 171         | 2317265.835        | 164.18   | 0.07                      |
| MOOSEGE17      | Collodaria  | 103         | 571228.3216        | 102.94   | 0.02                      |
| MOOSEGE17      | Collodaria  | 165         | 2363884.292        | 165.28   | 0.05                      |
| MOOSEGE17      | Collodaria  | 138         | 1179034.683        | 131.07   | 0.06                      |
| MOOSEGE17      | Collodaria  | 138         | 1281858.128        | 134.78   | 0.18                      |
| MOOSEGE17      | Nassellaria | 131         | 267587.4123        | 79.95    | 0.14                      |
| MOOSEGE17      | Nassellaria | 115         | 278585.8094        | 81.03    | 0.22                      |
| MOOSEGE17      | Nassellaria | 128         | 266264.7429        | 79.82    | 0.07                      |
| MOOSEGE17      | Challengeria| 258         | 7245191.541        | 240.08   | 0.61                      |
| MOOSEGE17      | Challengeria| 202         | 67169.4026         | 108.95   | 0.11                      |
| MOOSEGE17      | Challengeria| 146         | 244479.3621        | 77.58    | 0.14                      |
| MOOSEGE17      | Challengeria| 186         | 468032.8609        | 96.33    | 0.12                      |
| MOOSEGE17      | Challengeria| 186         | 468032.8609        | 96.33    | 0.07                      |
| MOOSEGE17      | Spumellaria | 195         | 3072241.535        | 180.36   | 0.85                      |
| MOOSEGE17      | Spumellaria | 199         | 3742163.018        | 192.62   | 0.62                      |
| MOOSEGE17      | Spumellaria | 108         | 632439.2531        | 106.50   | 0.05                      |
| MOOSEGE17      | Spumellaria | 145         | 420514.3667        | 92.95    | 0.11                      |
Table S2. Data used to estimate the proportions of living cells as function of depth in temperate waters based on studies that used the more reliable techniques (nuclear stains) to determine living cells.

| Source   | Depth (m) | % Poly live | % Ph live | % Poly live (equation) | % Ph live (equation) |
|----------|-----------|-------------|-----------|------------------------|----------------------|
| Gowing 89 | 50        | 100.0       | 100.0     | 73.1                   | 96.2                 |
| Gowing 86 | 50        | 75.1        | 95.1      | 73.1                   | 96.2                 |
| Gowing 86 | 50        | 74.7        | 100.0     | 73.1                   | 96.2                 |
| Gowing 89 | 100       | 53.5        | 100.0     | 58.1                   | 95.6                 |
| Gowing 89 | 130       | 38.7        | 100.0     | 52.5                   | 95.2                 |
| Gowing 89 | 150       | 30.8        | 100.0     | 49.4                   | 94.9                 |
| Gowing 86 | 150       | 31.5        | 86.3      | 49.4                   | 94.9                 |
| Gowing 89 | 225       | 88.0        | 95.4      | 40.7                   | 93.9                 |
| Gowing 89 | 275       | 72.7        | 97.3      | 36.3                   | 93.3                 |
| Gowing 89 | 300       | 35.1        | 86.6      | 34.5                   | 93.0                 |
| Gowing 86 | 300       | 11.0        | 92.7      | 34.5                   | 93.0                 |
| Gowing 86 | 500       | 0.0         | 100.0     | 23.5                   | 90.4                 |
| Gowing 89 | 600       | 18.8        | 100.0     | 19.5                   | 89.1                 |
| Gowing 86 | 700       | 6.3         | 71.5      | 16.2                   | 87.8                 |
| Gowing 86 | 700       | 0.7         | 84.1      | 16.2                   | 87.8                 |
| Gowing 89 | 750       | 0.0         | 64.0      | 14.7                   | 87.1                 |
| Gowing 89 | 750       | 7.7         | 100.0     | 14.7                   | 87.1                 |
| Gowing 89 | 900       | 11.8        | 91.8      | 10.8                   | 85.2                 |
| Gowing 86 | 900       | 2.6         | 92.0      | 10.8                   | 85.2                 |
| Gowing 89 | 1000      | 2.2         | 80.4      | 8.5                    | 83.9                 |
| Gowing 89 | 1000      | 2.0         | 43.2      | 8.5                    | 83.9                 |
| Gowing 86 | 1000      | 2.6         | 73.9      | 8.5                    | 83.9                 |
| Gowing 86 | 1100      | 0.0         | 100.0     | 6.5                    | 82.6                 |
| Gowing 89 | 1500      | 0.8         | 76.2      | -0.2                   | 77.4                 |
| Gowing 89 | 1500      | 3.3         | 42.8      | -0.2                   | 77.4                 |
| Gowing 89 | 1500      | 10.9        | 91.3      | -0.2                   | 77.4                 |
| Gowing 86 | 1500      | 1.1         | 87.9      | -0.2                   | 77.4                 |
| Gowing 89 | 2000      | 1.4         | 83.7      | -6.4                   | 70.9                 |
| Gowing 89 | 2000      | 0.2         | 43.6      | -6.4                   | 70.9                 |
| Gowing 89 | 2000      | 13.8        | 73.1      | -6.4                   | 70.9                 |
| Gowing 86 | 2000      | 1.7         | 60.8      | -6.4                   | 70.9                 |
| Gowing 86 | 2000      | 0.6         | 100.0     | -6.4                   | 70.9                 |
| Gowing 89 | 600       | 98.3        | 76.7      | Outlier, eliminated    |                      |

Mean % live 0-200 m | 61 | 96
Mean % live >200 m | 11 | 83
Table S3. Data used to estimate the proportions of living cells as function of depth in cold waters based on studies that used the more reliable techniques (nuclear stains) to determine living cells.

| Source  | Depth (m) | % Poly live | % Ph live | % Poly live (equation) | % Ph live (equation) |
|---------|-----------|-------------|-----------|------------------------|----------------------|
| Klaas 2001 | 12.5    | 100.0       | 100.0     | 92.3                   | 100.1                |
| Klaas 2001 | 12.5    | 97.0        | 100.0     | 92.3                   | 100.1                |
| Klaas 2001 | 12.5    | 88.5        | 95.0      | 92.3                   | 100.1                |
| Klaas 2001 | 12.5    | 82.0        | 100.0     | 92.3                   | 100.1                |
| Klaas 2001 | 12.5    | 87.5        | 97.0      | 92.3                   | 100.1                |
| Klaas 2001 | 12.5    | 95.0        | 100.0     | 92.3                   | 100.1                |
| Klaas 2001 | 37.5    | 94.5        | 97.0      | 91.4                   | 98.7                 |
| Klaas 2001 | 37.5    | 88.5        | 93.0      | 91.4                   | 98.7                 |
| Klaas 2001 | 37.5    | 95.5        | 100.0     | 91.4                   | 98.7                 |
| Klaas 2001 | 37.5    | 75.0        | 100.0     | 91.4                   | 98.7                 |
| Klaas 2001 | 37.5    | 87.5        | 100.0     | 91.4                   | 98.7                 |
| Klaas 2001 | 37.5    | 98.0        | 100.0     | 91.4                   | 98.7                 |
| Nothig91  | 50       | 84.0        | 96.5      | 91.0                   | 98.0                 |
| Nothig91  | 60       | 100.0       | 99.8      | 90.7                   | 97.4                 |
| Nothig91  | 60       | 84.0        | 98.7      | 90.7                   | 97.4                 |
| Klaas 2001 | 75      | 97.5        | 97.0      | 90.2                   | 96.6                 |
| Klaas 2001 | 75      | 98.0        | 100.0     | 90.2                   | 96.6                 |
| Klaas 2001 | 75      | 98.5        | 100.0     | 90.2                   | 96.6                 |
| Klaas 2001 | 75      | 100.0       | 100.0     | 90.2                   | 96.6                 |
| Klaas 2001 | 75      | 90.5        | 98.0      | 90.2                   | 96.6                 |
| Klaas 2001 | 75      | 83.5        | 92.0      | 90.2                   | 96.6                 |
| Klaas 2001 | 150     | 90.5        | 84.0      | 87.6                   | 92.5                 |
| Klaas 2001 | 150     | 97.5        | 100.0     | 87.6                   | 92.5                 |
| Klaas 2001 | 150     | 90.5        | 100.0     | 87.6                   | 92.5                 |
| Klaas 2001 | 150     | 90.5        | 96.0      | 87.6                   | 92.5                 |
| Klaas 2001 | 150     | 86.0        | 96.0      | 87.6                   | 92.5                 |
| Klaas 2001 | 150     | 88.5        | 94.0      | 87.6                   | 92.5                 |
| Nothig91  | 160     | 100.0       | 92.2      | 87.3                   | 91.9                 |
| Nothig91  | 160     | 71.5        | 94.6      | 87.3                   | 91.9                 |
| Nothig91  | 175     | 94.0        | 85.6      | 86.8                   | 91.1                 |
| Nothig91  | 350     | 92.0        | 62.8      | 80.8                   | 81.4                 |
| Nothig91  | 350     | 72.5        | 75.4      | 80.8                   | 81.4                 |
| Klaas 2001 | 350     | 83.0        | 50.0      | 80.8                   | 81.4                 |
| Klaas 2001 | 350     | 86.0        | 91.0      | 80.8                   | 81.4                 |
| Klaas 2001 | 350     | 77.5        | 86.0      | 80.8                   | 81.4                 |
| Klaas 2001 | 350     | 67.5        | 87.0      | 80.8                   | 81.4                 |
| Data Set S1. | Detail of the silica content of the rhizarians analysed per sample. ESD: equivalent spherical diameter. |
|-------------|-------------------------------------------------------------------------------------------------|
| Data Set S2. | Detail of the particulate organic carbon (POC) and particulate organic nitrogen (PON) content of the rhizarians analysed per sample. ESD: equivalent spherical diameter. |
| Data Set S3. | Database containing Polycystina and Phaeodaria densities (cells m$^{-3}$) from 1191 data points from 22 publications. This compilation, mainly based on Boltovskoy et al. (2010) was supplemented with more recent studies. These data were used to perform an estimate of rhizarians abundances worldwide. |