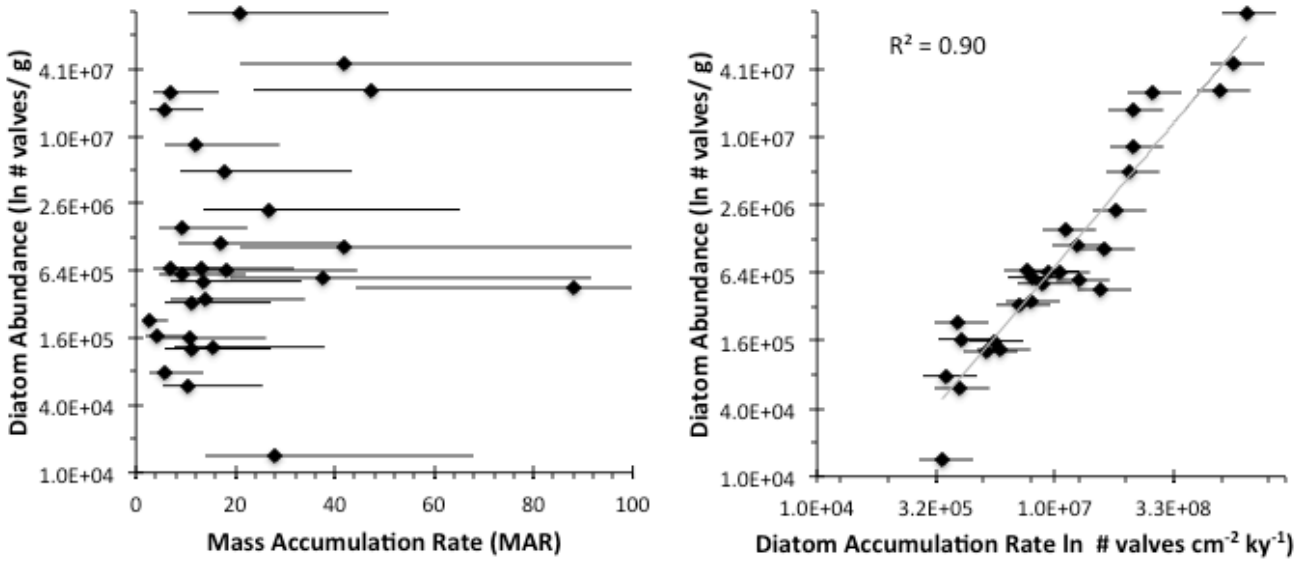
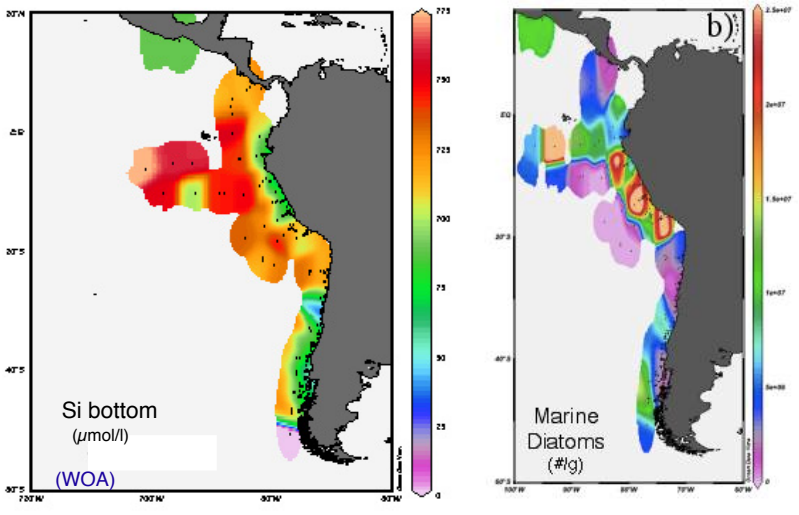
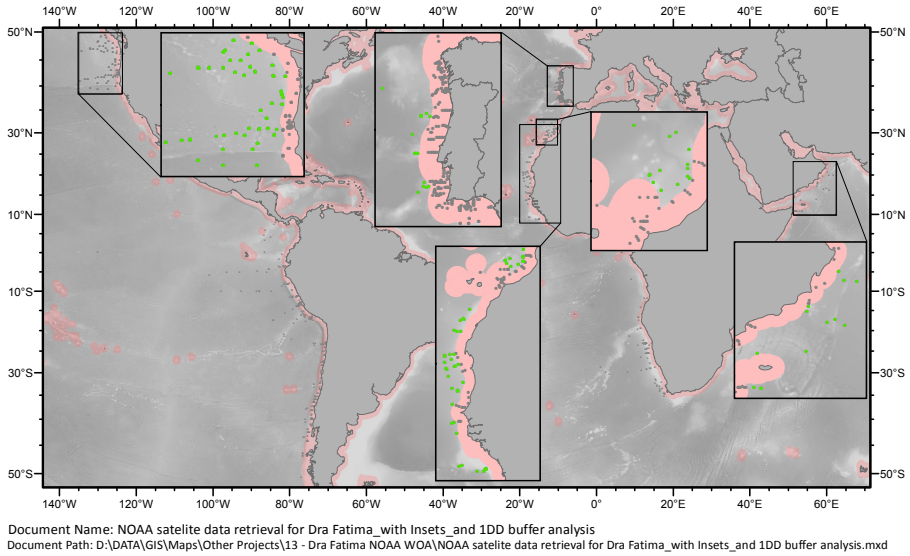


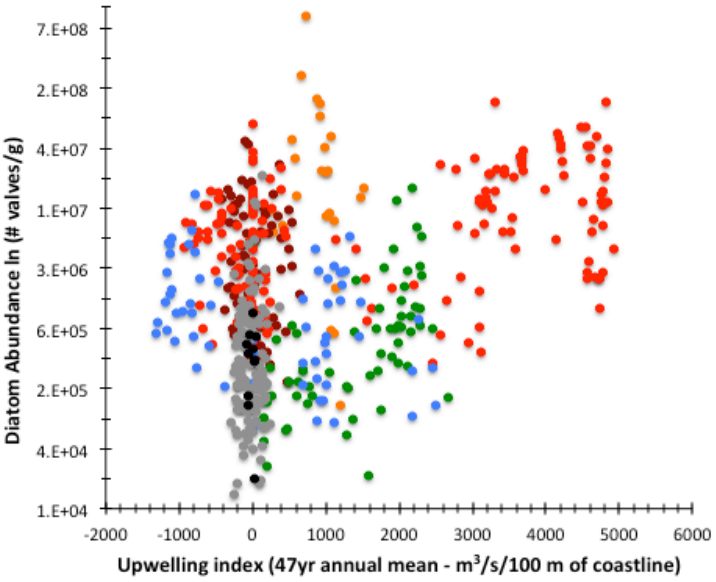

**SI Figure 1: Relationship between total marine diatom abundance ln (# valves /g) and Mass Accumulation Rate and Diatom Accumulation Rate ln (# valves $cm^{-2}$ $yr^{-1}$).**



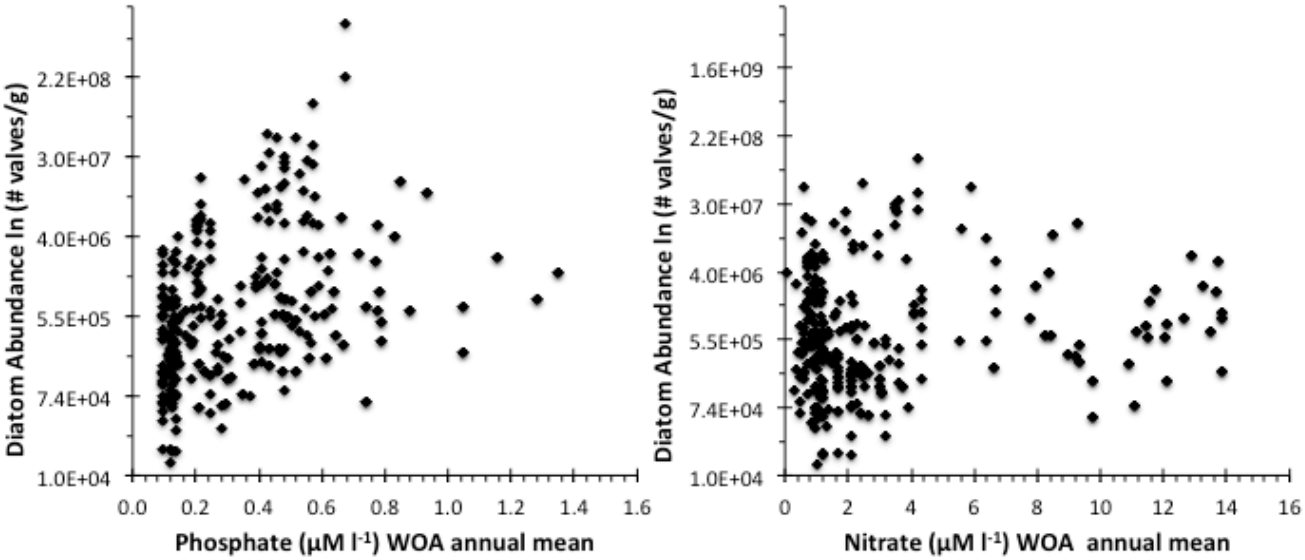

**SI Figure 2: Comparison of mean annual [$Si(OH)_4$] at the bottom (WOA09) and SDA along the Peru-Humboldt System.**



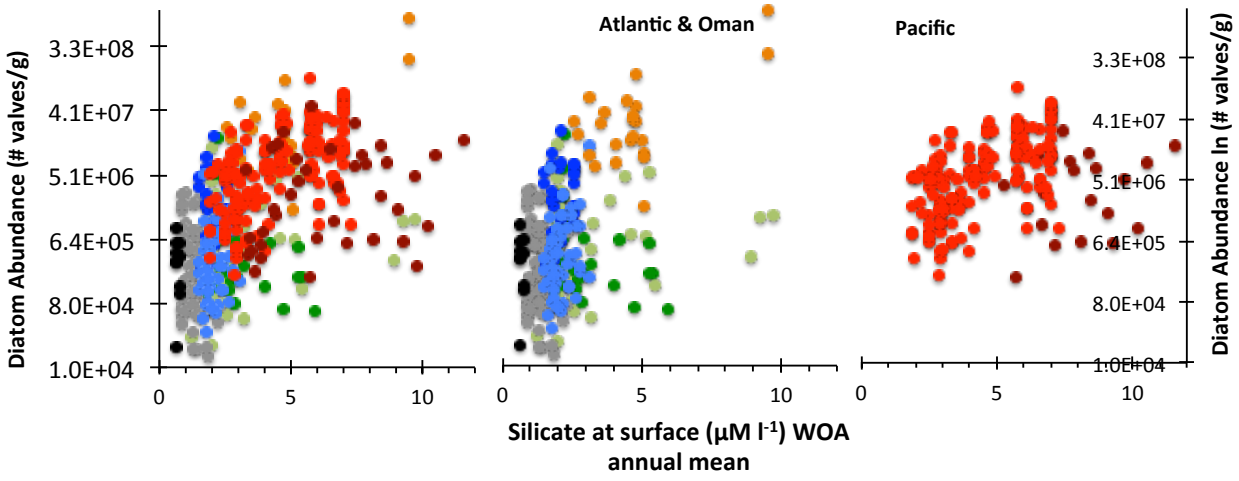

**SI Figure 3: Geographic distribution of the samples complying with the 1-mile distance to the coast (shaded area).**




**SI Figure 4: Relationship between total marine diatom abundance ln (# valves /g) and a 47yr mean annual geostrophic Ekman transport determined upwelling index, for the total dataset. Color scheme as in Figure 1.**




**SI Figure 5: Relationship between total marine diatom abundance ln (# valves /g) and surface water [$NO_3^-$] and [$PO_4^{2-}$] in µM from WOA 2013 database.**




**SI Figure 6: Relationship between total marine diatom abundance ln (# valves /g) and surface water [$Si(OH)_4^-$] in µM, from WOA 2013 database; A. Total dataset locations, B. Atlantic Ocean, C. Pacific Ocean. Color scheme as in Figure 1.**

| | All Areas | Nhemisphere | NH no Indian | SHemisphere | Atlantic | Pacific | Indian |
|---|---|---|---|---|---|---|---|
| DiatMAX | 4.10E+08 | 4.78E+06 | 7.52E+06 | 3.00E+07 | 1.66E+06 | 2.81E+08 | 2.21E+08 |
| SisurfMAX | 6.978 | 12.028 | 12.05 | 6.978 | 6.695 | 6.978 | 9.486 |
| DiatS | 1.61E+05 | 6.67E+04 | 1.61E+05 | 1.66E+05 | 3.98E+05 | 5.49E+05 | 1.64E+06 |
| SisurfS | 1.845 | 1.533 | 0.657 | 2.393 | 0.657 | 2.2912 | 3.65 |
| $V = V_{max}\ [S] / (K_s + [S])$ | | | | | | | |
| Increase by µM Sisurf | **3.E+08** | **4.E+06** | **7.E+06** | **2.E+07** | **2.E+06** | **2.E+08** | **2.E+08** |

**SI Table 1: The Michaelis-Menten hyperbolic relationship parameters defined from the long-term record of sediment diatom abundance (SDA) in the various upwelling systems separately as well as combined by ocean, hemisphere and as a whole; $V_{max}$ – $Diat_{MAX}$; [S] – $Si_{surfMAX}$; Ks – $Diat_S = Diat_{MAX}/2$; [S]– $Si_{surfS}$.**

| ID | Latitude | Longitude | Depth (m) | SR (cm/ky) | Reference |
|---|---|---|---|---|---|
| **Galiza** | | | | | |
| 11002-1 | 42.17 | -8.99 | 111 | 63.0 | (1) |
| 11039-1 | 41.55 | -9.08 | 99 | 27.0 | (1) |
| **PM** | | | | | |
| 2979 - PO8-2 | 37.64 | -9.93 | 2200 | 19.2 | (2) |
| 3010 - PO28-1 | 41.49 | -9.72 | 2160 | 7.5 | (2) |
| 3082 - MD95-2042 | 37.8 | -10.17 | 3146 | 20.0 | (3) |
| 3104- MD95-2040 | 40.58 | -9.86 | 2465 | 11.2 | (4) |
| **NW Africa** | | | | | |
| M4216-1 | 30.63 | -12.4 | 2324 | 5.0 | (5) |
| M4223-1 | 29.02 | -12.47 | 777 | 9.8 | (5) |
| M4228-1 | 29.47 | -12.99 | 1633 | 4.0 | (5) |
| GeoB7926-1 | 20.21 | -18.45 | 2500 | 12.2 | (6) |
| GeoB7920-3 | 20.75 | -18.58 | 2278 | 11.5 | (7) |
| **SW Africa** | | | | | |
| GeoB1704-1 | -19.41 | 11.62 | 399 | 8.0 | (8) |
| GeoB1705-2 | -19.50 | 11.38 | 647 | 13.1 | (8) |
| GeoB1707-2 | -19.70 | 10.66 | 1234 | 9.4 | (9) |
| GeoB1711-4 | -23.32 | 12.37 | 1975 | 10.0 | (10) |
| GeoB1712-1 | -23.25 | 12.81 | 1004 | 8.0 | (11) |
| GeoB1718-1 | -28.71 | 15.21 | 167 | 7.7 | (12) |
| GeoB1719-4 | -28.93 | 14.17 | 1023 | 6.5 | (9) |
| GeoB1720-4 | -29.00 | 13.84 | 2004 | 4.0 | (13) |
| GeoB1721-4 | -29.18 | 13.09 | 3079 | 2.9 | (14) |
| GeoB1722-3 | -29.45 | 11.75 | 3074 | 1.9 | (14) |
| GeoB3606-1 | -25.47 | 13.08 | 1793 | 30.0 | (9) |
| **SE Pacific** | | | | | |
| RR9702A-74 | -16.24 | -76.24 | 3 476 | 4.9 | (15) |
| ME005A-21 | 0.02 | -86.46 | 2 942 | 12.8 | (15) |
| **NE Pacific** | | | | | |
| W8709A13PC | 42.10 | -125.80 | | 30.0 | (16) |
| **Oman** | | | | | |
| NIOP 905 | 10.81 | 52.13 | 3540 | 33.9 | (17) |
| RC 2714 | 18.25 | 57.66 | 4040 | 15.0 | (18) |
| RC 2761 | 16.66 | 59.86 | 455 | 8.5 | (19) |

**SI Table 2: Site geographic location (latitude, longitude), water depth, sedimentation rate (SR) and published AMS $^{14}$C dates author.**

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