**Table S1 Calculated proxies based on APA kinetic parameters in samples**

**from the Challenger Deep, Mariana Trench**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Depth(m) | VDOPa(nM h-1) | Pregb(%) | $\frac{APA\left（PA\right）}{Km\left(PA\right)}$c  | $\frac{APA\left(FL\right)}{Km\left(FL\right)}$ d | DOP Turnovere (Month) | $\frac{DOP}{TDP}$f(%) |
| 50 | 56.67 | 92.2 | 0.21 |  0.05 |  13.0 | 46.1 |
| 1,000 | 35.00 | 76.7 | 0.63 |  0.12 |  6.2 | 17.3 |
| 2,000 | 37.50 | 69.0 | 0.63 |  0.14 |  5.8 | 3.3 |
| 3,000 | 33.33 | 66.0 | 0.28 |  0.18 |  6.1 | 12.4 |
| 4,200 | 35.83 | 59.5 | 0.36 |  0.12 |  6.6 | 5.6 |
| 7,000 | 35.00 | 60.4 | 0.47 |  0.16 |  5.1 | 8.6 |
| 10,918 | 35.83 | 59.5 | 0.67 |  0.16 |  5.4 | 3.2 |

aPotential hydrolysis rate of DOP at ambient concentrations, assuming the ambient DOP is

fully hydrolysable.

bRegenerated DIP, calculated based on Koeve et al. (2012).

c, dRatio of APA/Km for particle-associated and free-living fractions.

eDOP turnover time, calculated based on Duhamel et al. (2011).

fTDP, total dissolved phosphorus.