

1 **Supplement:**  
2 **Table S1. Sediment parameters and basic properties of all incubated samples**  
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| Sample location | Depth interval<br>[m] | SG <sup>a</sup>  | SO <sub>4</sub> <sup>2-b</sup><br>mg S kg <sup>-1</sup> | DOC <sup>c</sup>  | C <sub>hws</sub> <sup>d</sup><br>mg C kg | C <sub>l</sub> <sup>e</sup> | C <sub>org</sub> | total-S<br>mg S kg <sup>-1</sup> | total-N<br>mg N kg <sup>-1</sup> | Sand<br>[%] | Silt |
|-----------------|-----------------------|------------------|---|-------------------|--|-----------------------------|------------------|----------------------------------|----------------------------------|-------------|------|
|                 |                       |                  |   |                   |  |                             |                  |                                  |                                  |             |      |
| FFA B1          | 6.0-7.0               | s <sup>n</sup>   | 3.3   | 7.2               | 30.3                                     | 82.2                        | 643              | 86                               | 33                               | 95.0        | 5.0  |
| FFA B1          | 7.0-8.0               | s                | 3.3   | 5.7               | 32.3                                     | 887.0                       | 59551            | 603                              | 94                               | 94.8        | 5.2  |
| FFA B2          | 2.0-3.0               | n s <sup>n</sup> | 10.2  | 11.5              | 20.0                                     | 2.7                         | 237              | 29                               | 26                               | 98.9        | 0.2  |
| FFA B2          | 3.0-4.0               | n s <sup>n</sup> | 25.3  | 10.2              | 17.2                                     | 2.7                         | 203              | 38                               | 23                               | 98.9        | 0.2  |
| FFA B2          | 4.0-5.0               | n s <sup>n</sup> | 19.5  | 8.9               | 21.6                                     | 228.6                       | 545              | 46                               | 54                               | 96.4        | 1.3  |
| FFA B2          | 8.0-9.0               | s <sup>n</sup>   | 0.0   | 6.9               | 33.8                                     | 93.9                        | 1625             | 176                              | 31                               | 40.4        | 59.6 |
| FFA B2          | 9.0-10.0              | s <sup>n</sup>   | 0.9   | 6.2               | 40.0                                     | 116.9                       | 538              | 156                              | 28                               | 94.7        | 5.3  |
| FFA B4          | 7.0-8.0               | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | n.d. <sup>1</sup>                        | n.d. <sup>1</sup>           | 483              | 220                              | 21                               | 97.3        | 2.7  |
| FFA B4          | 8.0-9.0               | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | n.d. <sup>1</sup>                        | n.d. <sup>1</sup>           | 1114             | 359                              | 39                               | 95.4        | 4.7  |
| FFA B6          | 2.0-3.0               | n s <sup>n</sup> | 17.7  | 11.65             | 22.1                                     | 259.6                       | 695              | 56                               | 41                               | 97.8        | 0.6  |
| FFA B6          | 3.0-4.0               | n s <sup>n</sup> | 23.3  | 10.3              | 21.6                                     | 172.5                       | 1047             | 59                               | 46                               | 97.8        | 0.4  |
| FFA N10         | 4.5-5.0               | s <sup>n</sup>   | 5.4   | 9.2               | 22.2                                     | 462.7                       | 1291             | 50                               | 87                               | 94.9        | 1.0  |
| FFA N10         | 5.0-5.5               | s <sup>n</sup>   | 3.8   | 9.6               | 27.6                                     | 206.9                       | 737              | 49                               | 55                               | 98.0        | 0.3  |
| FFA N10         | 5.5-6.0               | s <sup>n</sup>   | 12.8  | 10.8              | 28.4                                     | 160.6                       | 687              | 49                               | 36                               | 97.4        | 0.4  |
| FFA N10         | 7.7-8.3               | s <sup>n</sup>   | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | 41.2                                     | n.d. <sup>1</sup>           | 311              | 57                               | 10                               | 96.3        | 3.8  |
| FFA N10         | 8.3-8.6               | s <sup>n</sup>   | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | 42.5                                     | n.d. <sup>1</sup>           | 320              | 47                               | 11                               | 97.9        | 2.2  |
| FFA N10         | 10.0-10.4             | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | n.d. <sup>1</sup>                        | n.d. <sup>1</sup>           | 310              | 45                               | 18                               | 96.3        | 3.7  |
| FFA N10         | 10.4-10.7             | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | n.d. <sup>1</sup>                        | n.d. <sup>1</sup>           | 5627             | 464                              | 113                              | 96.4        | 3.6  |
| FFA N10         | 12.0-13.0             | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | 0.0                                      | n.d. <sup>1</sup>           | 2554             | 558                              | 64                               | 96.7        | 3.3  |
| FFA N10         | 13.0-14.0             | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | 39.7                                     | n.d. <sup>1</sup>           | 1848             | 588                              | 53                               | 95.1        | 4.9  |
| FFA N10         | 16.0-17.0             | s                | 1.1   | 5.7               | 42.6                                     | 241.0                       | 2608             | 448                              | 51                               | 97.2        | 2.8  |
| FFA N10         | 17.0-18.0             | s                | n.d. <sup>1</sup>                                       | n.d. <sup>1</sup> | 41.1                                     | n.d. <sup>1</sup>           | 2504             | 441                              | 48                               | 96.9        | 3.1  |
| GKA             | 8.0-9.0               | n s <sup>n</sup> | 14.5  | 8.1               | 18.3                                     | 1.8                         | 102              | 54                               | 9                                | 96.8        | 1.4  |
| GKA             | 9.0-10.0              | n s <sup>n</sup> | 14.5  | 9.0               | 14.9                                     | 0.9                         | 76               | 38                               | 6                                | 97.3        | 0.9  |
| GKA             | 22.0-23.0             | n s <sup>n</sup> | 11.1  | 8.6               | 43.8                                     | 221.3                       | 176              | 42                               | 15                               | 95.4        | 1.2  |
| GKA             | 23.0-24.0             | n s <sup>n</sup> | 10.8  | 9.4               | 33.7                                     | 50.3                        | 192              | 36                               | 23                               | 96.0        | 0.9  |
| GKA             | 25.9-27.0             | s                | 8.2   | 6.1               | 31.1                                     | 1021.2                      | 2553             | 682                              | 69                               | 87.6        | 12.4 |
| GKA             | 27.0-28.3             | s                | 4.8   | 5.8               | 39.0                                     | 1531.1                      | 6373             | 989                              | 127                              | 79.6        | 20.4 |
| GKA             | 28.3-29.3             | s                | 10.3  | 8.1               | 27.4                                     | 2504.9                      | 4159             | 883                              | 114                              | 76.8        | 21.3 |
| GKA             | 29.3-30.3             | s                | 12.7  | 6.6               | 26.2                                     | 2205.8                      | 4543             | 760                              | 96                               | 83.9        | 14.2 |
| GKA             | 30.3-31.2             | s                | 13.6  | 5.2               | 28.9                                     | 347.7                       | 784              | 509                              | 14                               | 97.6        | 2.2  |
| GKA             | 31.3-32.0             | s                | 18.1  | 9.9               | 42.6                                     | 192.0                       | 834              | 494                              | 27                               | 96.5        | 3.2  |
| GKA             | 32.9-33.7             | s                | 20.2  | 5.1               | 20.8                                     | 377.4                       | 821              | 630                              | 23                               | 96.9        | 2.8  |
| GKA             | 33.7-34.7             | s                | 15.6  | 5.3               | 29.2                                     | 150.5                       | 752              | 510                              | 17                               | 98.5        | 1.4  |
| GKA             | 35.7-36.7             | s                | 2.2   | 5.4               | 32.0                                     | 2391.1                      | 8972             | 708                              | 120                              | 96.9        | 3.1  |
| GKA             | 36.7-37.7             | s                | 5.1   | 5.5               | 22.4                                     | 37.7                        | 232              | 677                              | 3                                | 98.8        | 1.2  |
| GKA             | 37.7-38.7             | s                | 0.5   | 4.7               | 23.2                                     | 447.4                       | 1162             | 379                              | 30                               | 97.8        | 2.3  |
| GKA             | 65.1-65.4             | s                | 1.8   | 6.2               | 23.7                                     | 239.8                       | 1009             | 716                              | 39                               | 89.4        | 10.7 |
| GKA             | 67.1-67.5             | n s              | 0.3   | 6.9               | 56.5                                     | 132.1                       | 358              | 196                              | 21                               | 92.1        | 7.9  |
| GKA             | 67.5-68.0             | n s              | 3.5   | 5.2               | 58.5                                     | n.d. <sup>1</sup>           | 377              | 194                              | 44                               | 94.7        | 5.3  |

5 <sup>a</sup> sediment group; <sup>b</sup> extractable sulfate-S; <sup>c</sup> extractable dissolved organic carbon; <sup>d</sup> extractable hot-water soluble  
6 carbon; <sup>e</sup> KMnO<sub>4</sub> labile organic carbon; <sup>1</sup> n.d.: not determined; n s non-sulphidic; s sulphidic aquifer material, n s  
7 and s with the subscript n indicates NO<sub>3</sub><sup>-</sup>-bearing samples.

1 **Table S2. Denitrification rates, long-term denitrification capacity, stock of reduced**  
 2 **compounds, sulphate formation capacity and estimated minimal lifetime of**  
 3 **denitrification of all incubated samples.**  
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| Sample location | Depth interval<br>[m] | SG <sup>a</sup>  | D <sub>r</sub> (7) <sup>b</sup>       | D <sub>cap</sub> <sup>d</sup>        | SRC <sup>e</sup>      | SRC <sub>C</sub> <sup>f</sup> | SRC <sub>S</sub> <sup>g</sup> | aF <sub>SRC</sub> <sup>h</sup> | SFC <sup>i</sup>                     | em. LoD <sup>j</sup> |
|-----------------|-----------------------|------------------|---------------------------------------|--------------------------------------|-----------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------------|----------------------|
|                 |                       |                  | $\mu\text{g N kg}^{-1} \text{d}^{-1}$ | $\text{mg N kg}^{-1} \text{yr}^{-1}$ | $\text{mg N kg}^{-1}$ |                               |                               | $\% \text{ yr}^{-1}$           | $\text{mg S kg}^{-1} \text{yr}^{-1}$ | yr                   |
| FFA B1          | 6.0-7.0               | s <sup>n</sup>   | 51.66                                 | 17.18                                | 659.6                 | 599.5                         | 60.1                          | 2.60                           | 6.1                                  | 5.0                  |
| FFA B1          | 7.0-8.0               | s                | 33.89                                 | 56.24                                | 5974.2                | 5552.7                        | 421.5                         | 0.94                           | 39.4                                 | 44.8                 |
| FFA B2          | 2.0-3.0               | n s <sup>n</sup> | 1.27                                  | 0.19                                 | 240.8                 | 220.7                         | 20.1                          | 0.08                           | 0.1                                  | 1.8                  |
| FFA B2          | 3.0-4.0               | n s <sup>n</sup> | 2.12                                  | 0.37                                 | 215.4                 | 189.2                         | 26.3                          | 0.17                           | -0.1                                 | 1.6                  |
| FFA B2          | 4.0-5.0               | n s <sup>n</sup> | 35.27                                 | 4.34                                 | 540.2                 | 508.0                         | 32.2                          | 0.80                           | 1.0                                  | 4.1                  |
| FFA B2          | 8.0-9.0               | s <sup>n</sup>   | 21.05                                 | 10.53                                | 1638.2                | 1515.5                        | 122.7                         | 0.64 <sup>(10.0)</sup>         | 3.5                                  | 12.3                 |
| FFA B2          | 9.0-10.0              | s <sup>n</sup>   | 41.41                                 | 12.68                                | 610.7                 | 502.0                         | 108.7                         | 2.08 <sup>(26.4)</sup>         | 2.2                                  | 4.6                  |
| FFA B4          | 7.0-8.0               | s                | 45.67                                 | 20.16                                | 603.6                 | 450.2                         | 153.4                         | 3.34                           | 9.6                                  | 4.5                  |
| FFA B4          | 8.0-9.0               | s                | 25.24                                 | 34.09                                | 1289.5                | 1038.9                        | 250.7                         | 2.64                           | 22.0                                 | 9.7                  |
| FFA B6          | 2.0-3.0               | n s <sup>n</sup> | 11.53                                 | 2.64                                 | 687.0                 | 648.9                         | 39.1                          | 0.38                           | 0.3                                  | 5.2                  |
| FFA B6          | 3.0-4.0               | n s <sup>n</sup> | 6.93                                  | 1.46                                 | 1017.4                | 976.5                         | 40.9                          | 0.14                           | 0.1                                  | 7.6                  |
| FFA N10         | 4.5-5.0               | s <sup>n</sup>   | 35.97                                 | 8.69                                 | 1239.0                | 1204.1                        | 34.8                          | 0.70                           | 1.5                                  | 9.3                  |
| FFA N10         | 5.0-5.5               | s <sup>n</sup>   | 61.03                                 | 8.75                                 | 721.6                 | 687.1                         | 34.5                          | 1.21                           | 2.1                                  | 5.4                  |
| FFA N10         | 5.5-6.0               | s <sup>n</sup>   | 36.99                                 | 7.82                                 | 674.6                 | 640.3                         | 34.3                          | 1.16                           | 5.2                                  | 5.1                  |
| FFA N10         | 7.7-8.3               | s <sup>n</sup>   | 33.71                                 | 15.04                                | 329.5                 | 290.0                         | 39.5                          | 4.56                           | 1.5                                  | 2.5                  |
| FFA N10         | 8.3-8.6               | s <sup>n</sup>   | 20.25                                 | 15.17                                | 331.5                 | 298.7                         | 32.9                          | 4.58                           | 6.9                                  | 2.5                  |
| FFA N10         | 10.0-10.4             | s                | 12.34                                 | 17.45                                | 320.6                 | 289.3                         | 31.3                          | 5.44                           | 5.4                                  | 2.4                  |
| FFA N10         | 10.4-10.7             | s                | 23.75                                 | 50.07                                | 5571.6                | 5247.7                        | 323.9                         | 0.90                           | 9.4                                  | 41.8                 |
| FFA N10         | 12.0-13.0             | s                | 26.47                                 | 52.84                                | 2771.3                | 2381.7                        | 389.6                         | 1.91                           | 37.9                                 | 20.8                 |
| FFA N10         | 13.0-14.0             | s                | 35.58                                 | 38.04                                | 2134.1                | 1723.3                        | 410.8                         | 1.78                           | 18.2                                 | 16.0                 |
| FFA N10         | 16.0-17.0             | s                | 69.90                                 | 46.65                                | 2744.7                | 2431.5                        | 313.2                         | 1.70 <sup>(6.3)</sup>          | 23.6                                 | 20.6                 |
| FFA N10         | 17.0-18.0             | s                | 34.48                                 | 46.55                                | 2642.7                | 2335.0                        | 307.8                         | 1.76 <sup>(6.3)</sup>          | 36.8                                 | 19.8                 |
| GKA             | 8.0-9.0               | n s <sup>n</sup> | 0.81                                  | 0.63                                 | 132.6                 | 95.0                          | 37.6                          | 0.47                           | 0.9                                  | 1.0                  |
| GKA             | 9.0-10.0              | n s <sup>n</sup> | 0.71                                  | 0.34                                 | 97.1                  | 70.7                          | 26.4                          | 0.35                           | 0.4                                  | 0.7                  |
| GKA             | 22.0-23.0             | n s <sup>n</sup> | 14.68                                 | 1.57                                 | 193.3                 | 164.2                         | 29.1                          | 0.81                           | 0.2                                  | 1.5                  |
| GKA             | 23.0-24.0             | n s <sup>n</sup> | 31.77                                 | 2.83                                 | 204.5                 | 179.2                         | 25.3                          | 1.38                           | 0.0                                  | 1.5                  |
| GKA             | 25.9-27.0             | s                | 26.36                                 | 15.63                                | 2857.4                | 2381.0                        | 476.4                         | 0.55                           | 1.2                                  | 21.4                 |
| GKA             | 27.0-28.3             | s                | 29.43                                 | 41.82                                | 6634.0                | 5943.2                        | 690.8                         | 0.63 <sup>(4.9)</sup>          | 8.3                                  | 49.8                 |
| GKA             | 28.3-29.3             | s                | 46.38                                 | 37.82                                | 4495.6                | 3878.5                        | 617.2                         | 0.84 <sup>(7.3)</sup>          | 13.8                                 | 33.7                 |
| GKA             | 29.3-30.3             | s                | 57.08                                 | 35.49                                | 4766.8                | 4236.0                        | 530.8                         | 0.74 <sup>(6.4)</sup>          | 8.1                                  | 35.8                 |
| GKA             | 30.3-31.2             | s                | 26.07                                 | 6.54                                 | 1086.9                | 731.4                         | 355.4                         | 0.60                           | 3.8                                  | 8.2                  |
| GKA             | 31.3-32.0             | s                | 14.06                                 | 4.09                                 | 1122.4                | 777.7                         | 344.7                         | 0.36                           | 5.0                                  | 8.4                  |
| GKA             | 32.9-33.7             | s                | 38.39                                 | 7.28                                 | 1206.0                | 765.6                         | 440.4                         | 0.60                           | 10.2                                 | 9.1                  |
| GKA             | 33.7-34.7             | s                | 62.14                                 | 12.25                                | 1057.4                | 700.9                         | 356.6                         | 1.16                           | 17.7                                 | 7.9                  |
| GKA             | 35.7-36.7             | s                | 64.30                                 | 52.46                                | 8861.3                | 8366.7                        | 494.6                         | 0.59 <sup>(4.6)</sup>          | 30.0                                 | 66.5                 |
| GKA             | 36.7-37.7             | s                | 87.51                                 | 11.07                                | 689.6                 | 216.7                         | 472.8                         | 1.60                           | 9.2                                  | 5.2                  |
| GKA             | 37.7-38.7             | s                | 109.2                                 | 12.06                                | 1347.7                | 1083.1                        | 264.7                         | 0.89 <sup>(15.3)</sup>         | 4.6                                  | 10.1                 |
| GKA             | 65.1-65.4             | s                | 33.12                                 | 13.22                                | 1441.2                | 941.3                         | 499.9                         | 0.92                           | 1.3                                  | 10.8                 |
| GKA             | 67.1-67.5             | n s              | 30.54                                 | 8.18                                 | 471.0                 | 333.8                         | 137.2                         | 1.74                           | 1.3                                  | 3.5                  |
| GKA             | 67.5-68.0             | n s              | 23.62                                 | 8.11                                 | 487.1                 | 351.5                         | 135.6                         | 1.67                           | 0.7                                  | 3.7                  |

5 <sup>a</sup> sediment group; <sup>b</sup> initial denitrification rate; <sup>c</sup> average denitrification rate after one year; <sup>d</sup> measurable  
 6 denitrification capacity after one year; <sup>e</sup> depot of reactive compounds (SRC); <sup>f</sup> concentration of reduced

1 compounds derived from measured  $C_{org}$ ; <sup>g</sup> concentration of reduced compounds derived from total-S values; <sup>h</sup>  
 2 fraction of SRC available for denitrification during one year of incubation, in parenthesis  $aF_{SRC}$  from the  
 3 intensive treatment; <sup>i</sup> sulphate formation capacity (SFC); <sup>j</sup> estimated minimal lifetime of denitrification; n s non-  
 4 sulphidic; s sulphidic aquifer material, n s and s with the subscript n indicates  $NO_3^-$ -bearing samples.  
 5

6 **Table S3. Simple regression between  $D_{cap}$  and sediment parameters (X),**  
 7  **$f^{B-C}(D_{cap}) = A + B \times f^{B-C}(X)$ . Regressions with  $C_{org}$ , total-S are listed for each partial data set.**  
 8 **Regression with a third independent sediment variable are only given, if correlation coefficient**  
 9 **were better compared to correlations with  $C_{org}$  or total-S.**  
 10

| data-set          | X <sup>a</sup>      | N <sup>b</sup> | R <sup>c</sup> | A        | B        |
|-------------------|---------------------|----------------|----------------|----------|----------|
| whole dataset     | $C_{org}$           | 151            | 0.80           | -11.022  | 2.654    |
| whole dataset     | total-S             | 151            | 0.71           | -2.397   | 0.805    |
| whole dataset     | $C_1$               | 111            | 0.83           | -1.028   | 0.492    |
| FFA               | $C_{org}$           | 86             | 0.72           | -26.950  | 8.017    |
| FFA               | total-S             | 86             | 0.83           | -14.879  | 6.312    |
| FFA               | DOC <sub>extr</sub> | 46             | 0.84           | 10.503   | -0.495   |
| GKA               | $C_{org}$           | 65             | 0.93           | -9.525   | 2.457    |
| GKA               | total-S             | 65             | 0.86           | -0.252   | 0.026    |
| GKA               | $C_1$               | 65             | 0.93           | -0.730   | 0.416    |
| non-sulphidic     | $C_{org}$           | 44             | 0.52           | -5.434   | 1.205    |
| non-sulphidic     | total-S             | 44             | 0.77           | -231.440 | 284.854  |
| non-sulphidic     | $C_{hws}$           | 44             | 0.77           | -164.600 | 233.898  |
| sulphidic         | $C_{org}$           | 107            | 0.66           | -3.097   | 1.293    |
| sulphidic         | total-S             | 107            | 0.40           | 2.747    | 0.001    |
| sulphidic         | $C_1$               | 67             | 0.60           | -0.119   | 0.638    |
| $NO_3^-$ -bearing | $C_{org}$           | 64             | 0.58           | -4.946   | 0.661    |
| $NO_3^-$ -bearing | total-S             | 64             | 0.67           | -268.670 | 312.977  |
| $NO_3^-$ -bearing | $C_1$               | 56             | 0.73           | -0.737   | 0.267    |
| $NO_3^-$ -free    | $C_{org}$           | 87             | 0.77           | -5.862   | 1.623    |
| $NO_3^-$ -free    | total-S             | 87             | 0.32           | 3.741    | 0.004    |
| transition zone   | $C_{org}$           | 28             | 0.58           | 18.117   | -4.020   |
| transition zone   | total-S             | 28             | 0.20           | -178.180 | 277.350  |
| transition zone   | $C_1$               | 20             | 0.73           | 192.880  | -190.340 |

11 <sup>a</sup> Independent sediment parameter

12 <sup>b</sup> Sample number

13 <sup>c</sup> Correlation coefficient

14

15

16

1 Table: S4. Ratios of modelled  $D_{cap}$  vs measured  $D_{cap}$  (group means with standard deviation,  
 2 ranges in parentheses) for samples with high ( $> 20 \text{ mg N kg}^{-1}$ ) and low  $D_{cap}$  ( $< 20 \text{ mg N kg}^{-1}$ )  
 3

| Data-set        | Modelled $D_{cap}$ / Measured $D_{cap}$                |                              |                             |                              |                              |                              |
|-----------------|--|------------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|
|                 | Multiple regressions                                   |                              |                             | Simple regressions           |                              |                              |
|                 | Selection I  | Selection II                 | Selection III               | Corg                         | Total-S                      | Best                         |
|                 | $D_{cap} \geq 20 \text{ mg N kg}^{-1} \text{ yr}^{-1}$ |                              |                             |                              |                              |                              |
| Whole data-set  | 0.88 ±0.33<br>(0.33 – 1.67)                            | 0.89 ±0.28<br>(0.39 – 1.26)  | 0.87 ±0.24<br>(0.55 – 1.30) | 0.86 ±0.32<br>(0.29 – 1.53)  | 0.68 ±0.25<br>(0.42 – 1.54)  | 0.83 ±0.38<br>(0.22 – 1.35)  |
| FFA             | 0.86 ±0.12<br>(0.71 – 1.26)                            | 0.86 ±0.50<br>(0.79 – 0.93)  | 0.84 ±0.07<br>(0.74 – 0.94) | 0.71 ±0.17<br>(0.30 – 1.08)  | 0.86 ±0.15<br>(0.68 – 1.29)  | 0.57 ±0.06<br>(0.49 – 0.66)  |
| GKA             | 0.89 ±0.33<br>(0.41 – 1.47)                            | 1.14 ±0.18<br>(0.78 – 1.38)  | 1.08 ±0.19<br>(0.79 – 1.34) | 1.14 ±0.19<br>(0.88 – 1.46)  | 0.84 ±0.30<br>(0.39 – 1.38)  | 1.13 ±0.26<br>(0.67 – 1.51)  |
| sulphidic       | 0.73 ±0.22<br>(0.44 – 1.35)                            | 0.78 ±0.16<br>(0.57 – 1.13)  | 1.15 ±0.38<br>(0.81 – 2.05) | 0.74 ±0.22<br>(0.43 – 1.36)  | 0.33 ±0.09<br>(0.23 – 0.68)  | 0.66 ±0.25<br>(0.28 – 1.19)  |
|                 | $D_{cap} < 20 \text{ mg N kg}^{-1} \text{ yr}^{-1}$    |                              |                             |                              |                              |                              |
| Whole data-set  | 2.29 ±3.06<br>(0.20 – 18.28)                           | 1.90 ±2.27<br>(0.17 – 11.08) | 1.38 ±1.02<br>(0.34 – 6.23) | 2.69 ±4.40<br>(0.23 – 26.07) | 3.03 ±3.85<br>(0.20 – 18.32) | 1.72 ±1.49<br>(0.23 – 8.79)  |
| FFA             | 2.52 ±3.03<br>(0.23 – 12.41)                           | 1.77 ±1.44<br>(0.34 – 5.69)  | 1.14 ±0.66<br>(0.26 – 3.41) | 3.56 ±4.90<br>(0.24 – 20.27) | 2.63 ±3.39<br>(0.25 – 13.64) | 2.19 ±2.53<br>(0.18 – 11.82) |
| GKA             | 1.73 ±1.29<br>(0.31 – 5.51)                            | 1.35 ±0.71<br>(0.23 – 3.10)  | 1.19 ±0.43<br>(0.30 – 2.16) | 1.39 ±0.82<br>(0.23 – 3.99)  | 1.76 ±1.38<br>(0.34 – 6.02)  | 1.35 ±0.68<br>(0.23 – 3.02)  |
| non-sulphidic   | 1.36 ±1.04<br>(0.18 – 5.23)                            | 1.36 ±1.04<br>(0.18 – 5.23)  | 1.09 ±0.45<br>(0.52 – 0.45) | 1.94 ±2.39<br>(0.21 – 10.45) | 1.47 ±1.00<br>(0.18 – 8.25)  | 1.55 ±0.94<br>(0.24 – 7.26)  |
| sulphidic       | 1.49 ±0.84<br>(0.51 – 4.33)                            | 1.29 ±0.66<br>(0.33 – 3.13)  | 1.39 ±0.60<br>(0.43 – 3.19) | 1.48 ±0.84<br>(0.50 – 4.36)  | 1.27 ±0.61<br>(0.69 – 3.69)  | 1.46 ±0.76<br>(0.44 – 3.49)  |
| transition zone | 1.03 ±0.22<br>(0.71 – 1.52)                            | 1.03 ±0.22<br>(0.67 – 1.56)  | 1.01 ±0.13<br>(0.84 – 1.27) | 1.05 ±0.27<br>(0.64 – 1.77)  | 1.07 ±0.32<br>(0.67 – 1.73)  | 1.03 ±0.24<br>(0.72 – 1.58)  |

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5 Table S5. Lambda values of the Box-Cox transformed sediment parameters  
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| Data-set          | Lambda values |           |            |           |        |           |         |                    |              |           |        |
|-------------------|---------------|-----------|------------|-----------|--------|-----------|---------|--------------------|--------------|-----------|--------|
|                   | $D_r(7)$      | $D_r(84)$ | $D_r(168)$ | $D_{cap}$ | silt   | $C_{org}$ | total-S | $SO_4^{2-}_{extr}$ | $DOC_{extr}$ | $C_{hws}$ | $C_l$  |
| whole dataset     | 0.512         | 0.346     | 0.341      | 0.294     | 0.021  | -0.056    | 0.132   | 0.700              | -0.213       | 0.040     | 0.171  |
| FFA               | 0.626         | 0.441     | 0.428      | 0.370     | 0.007  | -0.176    | -0.196  | 0.347              | 1.426        | 0.811     | 0.364  |
| GKA               | 0.503         | 0.345     | 0.259      | 0.208     | -0.206 | -0.080    | 0.750   | 0.670              | -0.789       | -0.133    | 0.170  |
| non-sulphidic     | 0.220         | 0.100     | 0.172      | 0.106     | -0.069 | -0.050    | -1.217  | 0.784              | 0.732        | -1.400    | 0.758  |
| sulphidic         | 0.219         | 0.209     | 0.305      | -0.059    | -0.067 | -0.111    | 1.100   | 0.358              | -2.02        | 0.635     | -0.059 |
| $NO_3^-$ -bearing | 0.408         | 0.134     | 0.221      | 0.235     | -0.210 | 0.108     | -1.145  | 0.650              | 1.401        | -0.039    | 0.261  |
| $NO_3^-$ -free    | 0.160         | 0.103     | 0.313      | 0.144     | -0.337 | -0.017    | 0.950   | 0.214              | -2.422       | -0.335    | 0.230  |

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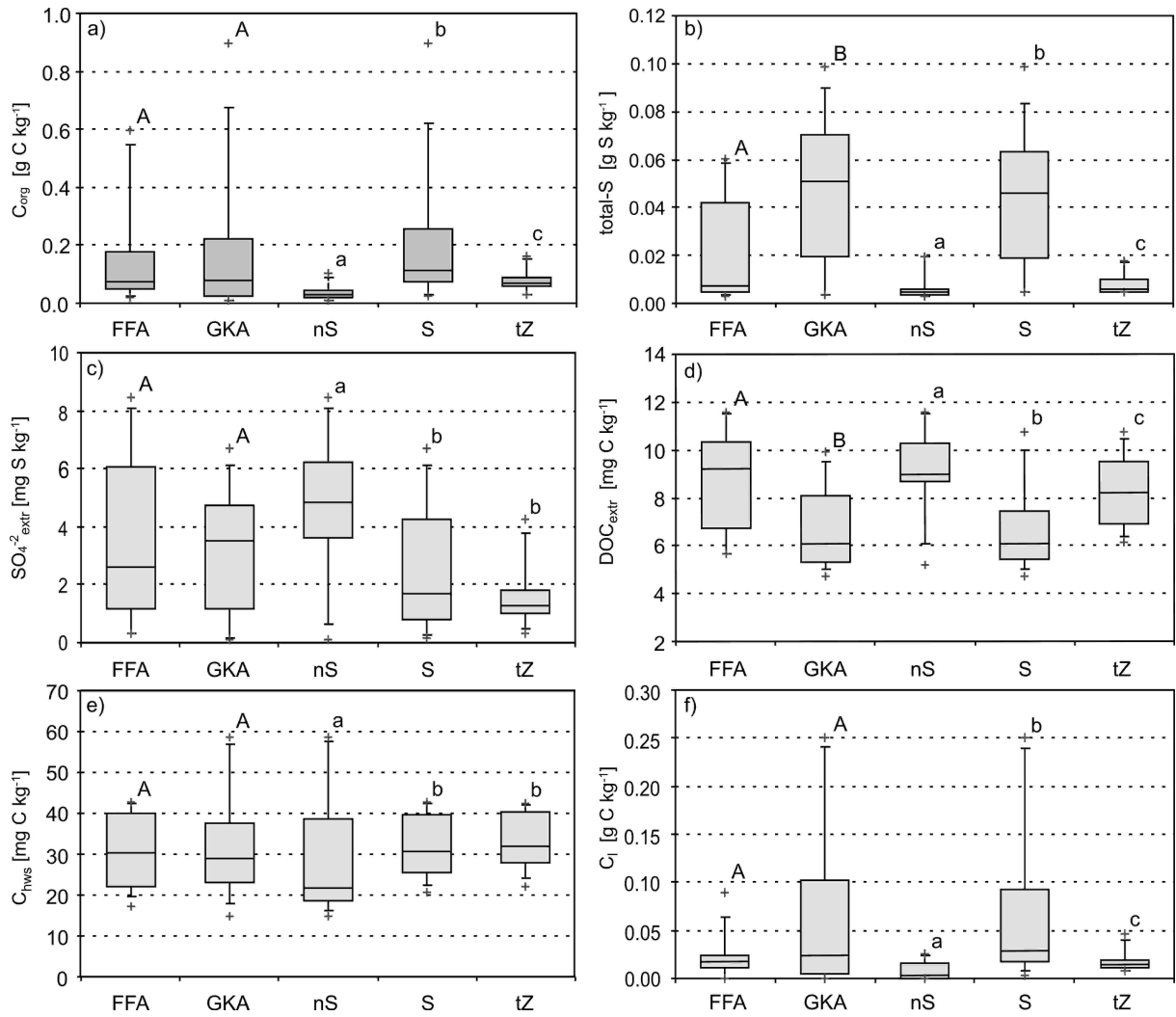
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Fig. S1: Distribution of different sediment parameters in the aquifer material from the Fuhrberger Feld aquifer (FFA) and the Großenkneten aquifer (GKA) and in the various established groups of aquifer material: a) organic carbon, b) total sulphur, c) extractable sulphate, d) extractable dissolved organic carbon, e) hot water soluble organic carbon, f) potassium permanganate labile organic carbon. n S, S and tZ indicate non sulphidic -, sulphidic - and transition zone aquifer material, respectively. Different uppercase letters above the box-plots indicate significant differences between FFA and GKA material, different small letters show significant differences between n S, S and tZ (Kruskal-Wallis-Test ( $P < 0.05$ )).