# SUPPORTING INFORMATION

# The shape and speciation of Ag nanoparticles drive their impacts on organisms in a lotic ecosystem

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is defined as OTUs that are present in 80% of the samples. The different OTUs that make up this core microbiome are represented by numbers and a corresponding color in the legend of each graph.

Figure S13. Box plot showing Lipid peroxidation (TBARS) in *G. fossarum* after 28 days of exposure. Red crosses are means, horizontal central bars are medians, inferior and superior limits of boxes are respectively first and third quartiles, inferior and superior vertical bars are respectively minimum and maximum values. * indicates a significant difference with the control group ($p<0.05$).

Table S1. Table of all statistical results presented in Figure S4 regarding the Alpha diversity at Day 0 in microbiomes from the surficial sedimentary compartment (SC) and the water column compartment (WC) of the mesocosms spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 Index, Shannon and Simpson Indexes.

Table S2. Table of all statistical results presented in Figure S10 regarding the Alpha diversity at Day 28 in microbiomes from the surficial sedimentary compartment (SC) and the water column compartment (WC) of the mesocosms spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 Index, Shannon and Simpson indexes.

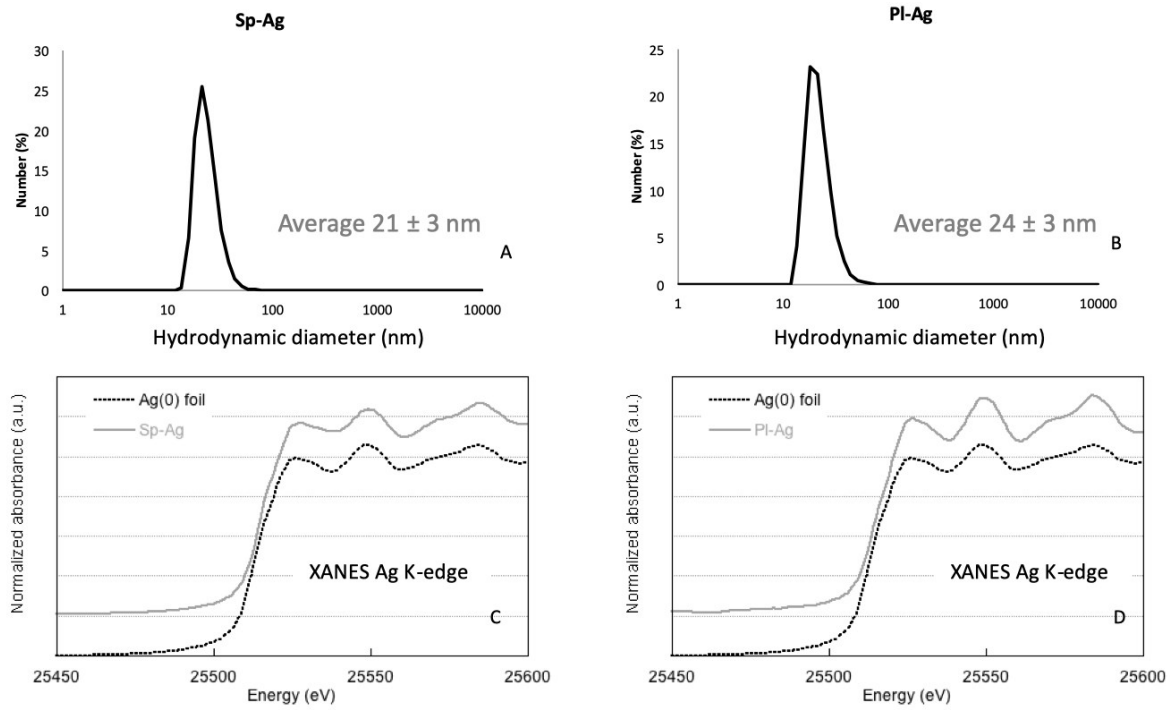


Figure S1. (A, B) Distribution of the hydrodynamic diameters in the stock suspension (20 mg.L-1) obtained using DLS. (C, D) Ag K-edge XANES spectra of the initial particles obtained on the FAME beamline (BM30b) at the ESRF (Grenoble, France).

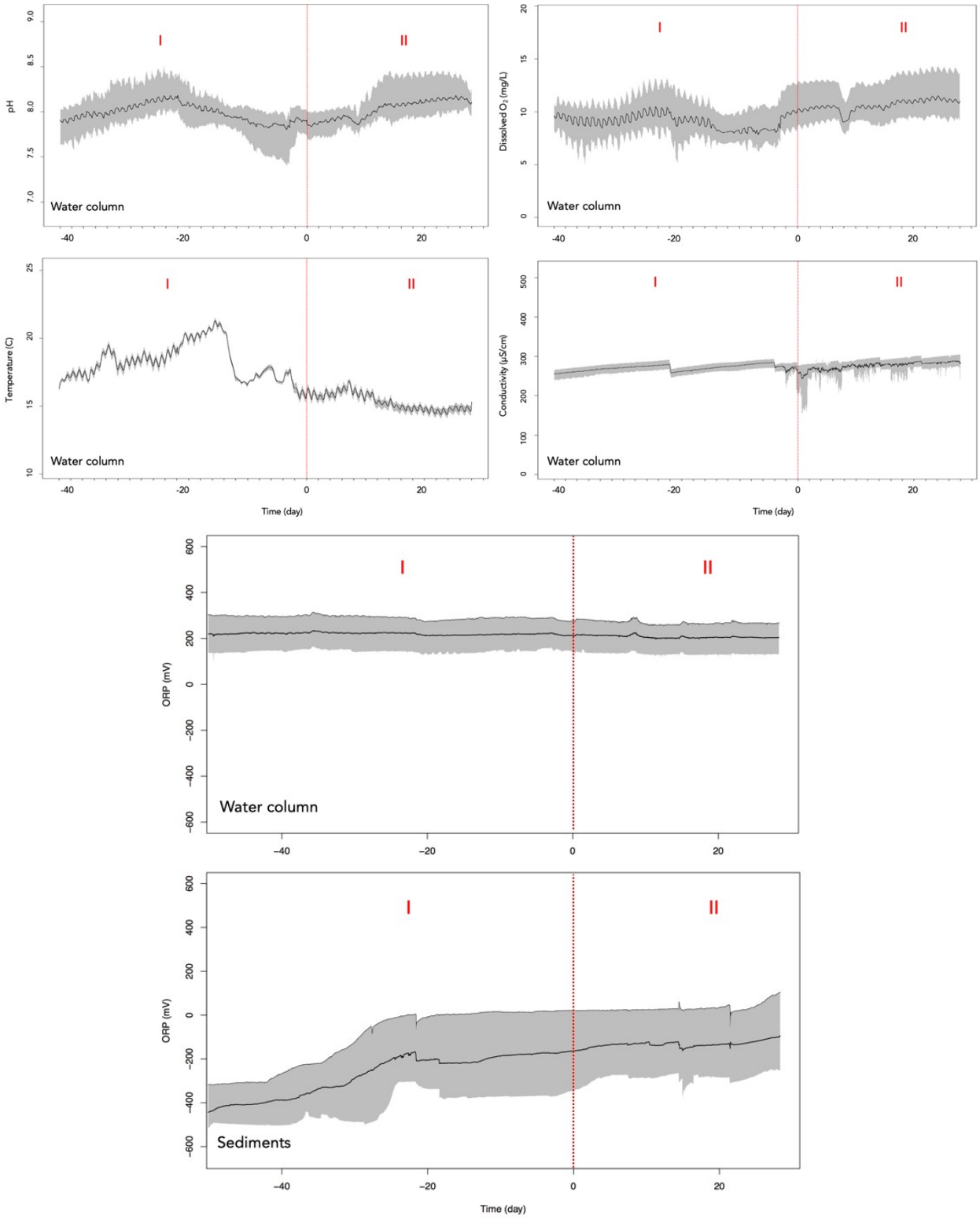


Figure S2. Evolution of the physico-chemical parameters. pH, dissolved oxygen, temperature, conductivity, and oxido-reduction potential (ORP) in the water columns and the sediments measured during phases I and II. The grey surface is defined by the maximum and minimum values of each parameter, the dark line corresponds to the average values of the 9 mesocosms, and the red dotted line separate phases I and II. One measurement was performed every 5 min.

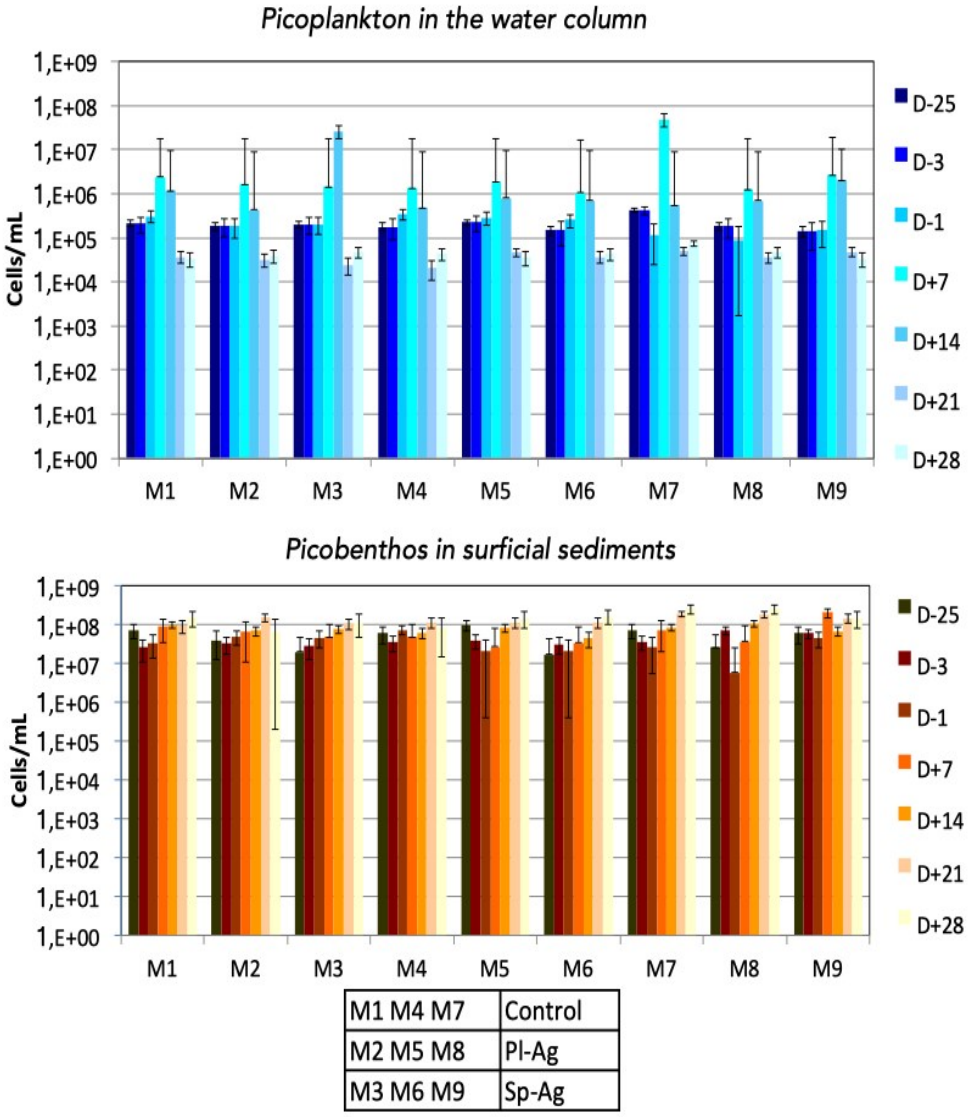


Figure S3. Number of picoplankton and picobenthos (in the water column and surficial sediments) over time in the nine mesocosms.

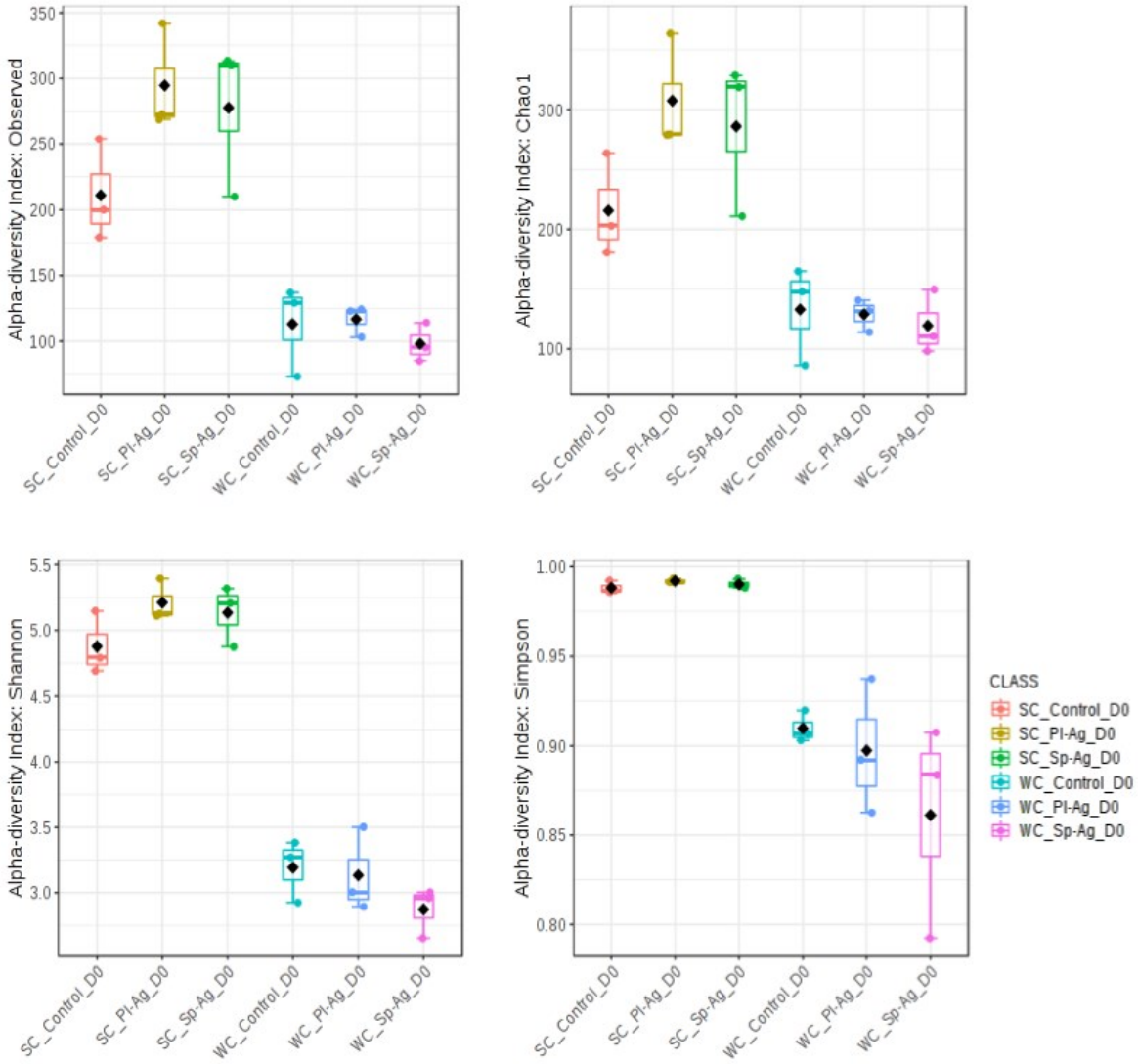


Figure S4. Alpha diversity at Day 0 in microbiomes from the surficial sedimentary compartment (SC) and the water column compartment (WC) of the mesocosms spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 Index, Shannon and Simpson Indexes. See Table S1 for more details.

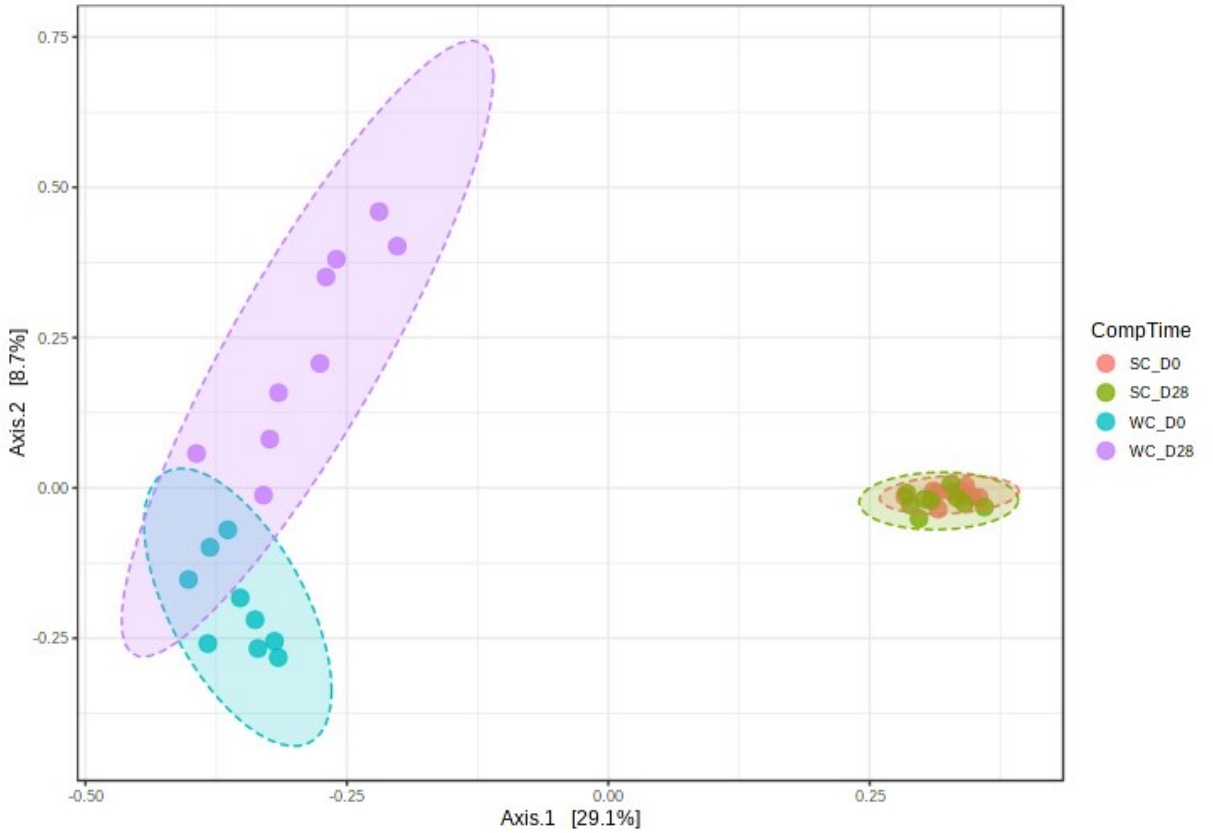


Figure S5. Principal-coordinate analysis (PCoA) of Bray-Curtis dissimilarity based on 16s rRNA gene amplicons of surficial sediment compartment (SC) at Day 0 (coral dots) and Day 28 (green dots) and water column compartment (WC) at Day 0 (blue dots) at Day 28 (purple dots). The two first axes explain 37.8% of the variance. **PERMANOVA variable compartment**: F-value: 11.075; R-squared: 0.40906; p-value < 0.001; **variable time**: F-value: 1.8881; R-squared: 0.10555; p-value < 0.001; **compartment-treatment interaction** F-value: 7.0003; R-squared: 0.39624; p-value < 0.001.

Figure S6. Picture of the development of a biofilm of diatomaceous Brown Algae on water tank of one replicate (contaminated with Pl-Ag) during the equilibration phase (phase I).

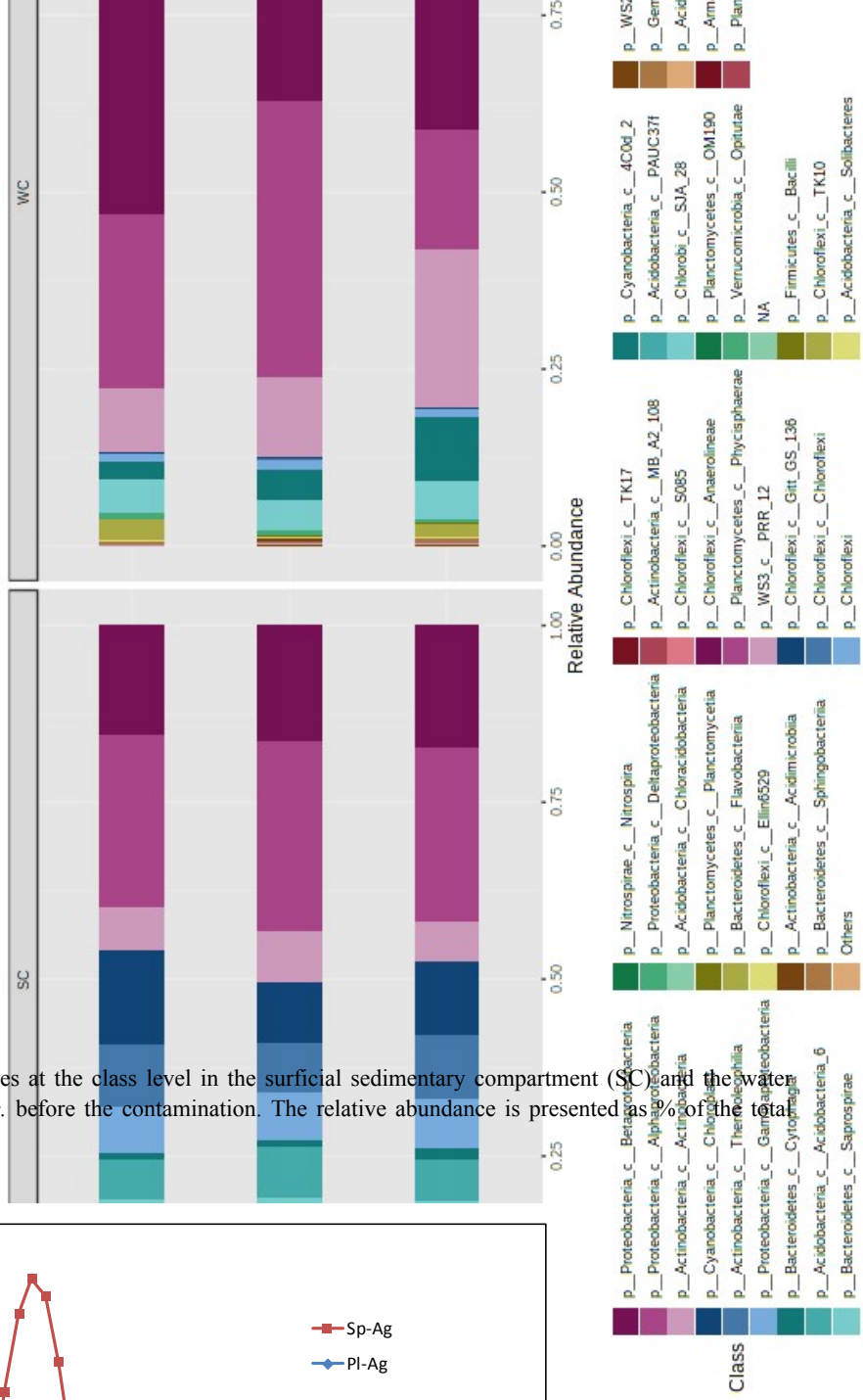


Figure S7. Bacterial community structures at the class level in the surficial sedimentary compartment (SC) and the water column compartment (WC) at Day 0 *i.e.* before the contamination. The relative abundance is presented as % of the total bacterial sequences.

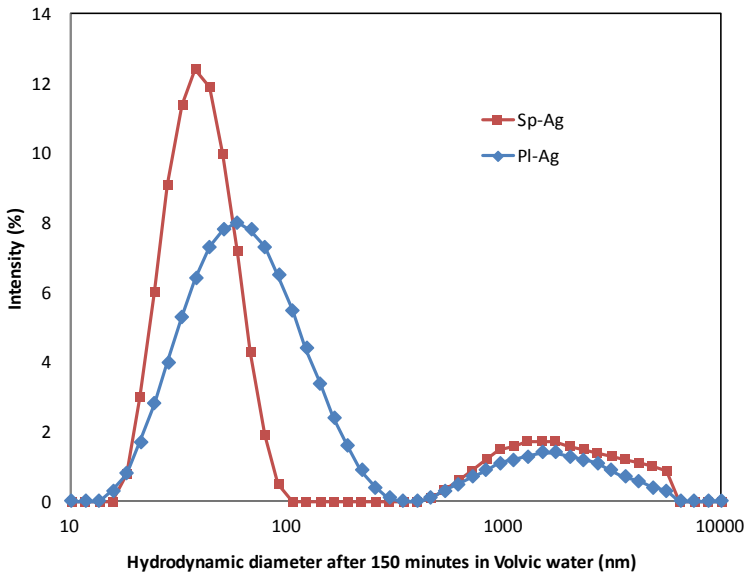


Figure S8. Hydrodynamic diameter distributions of the Sp-Ag and Pl-Ag after 150 minutes in Volvic® water measured by laser granulometry.

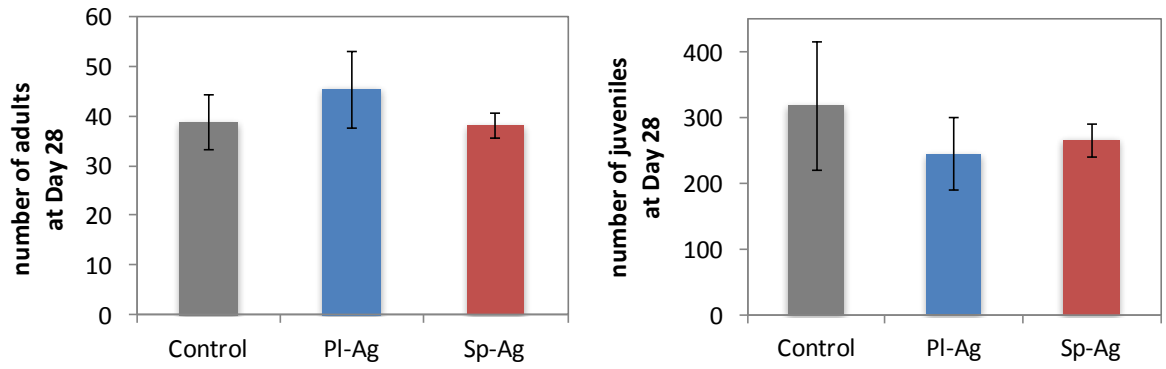


Figure S9. Number of adults (left) and juveniles (right) *Gammarus fossarum* after 28 days of exposure.

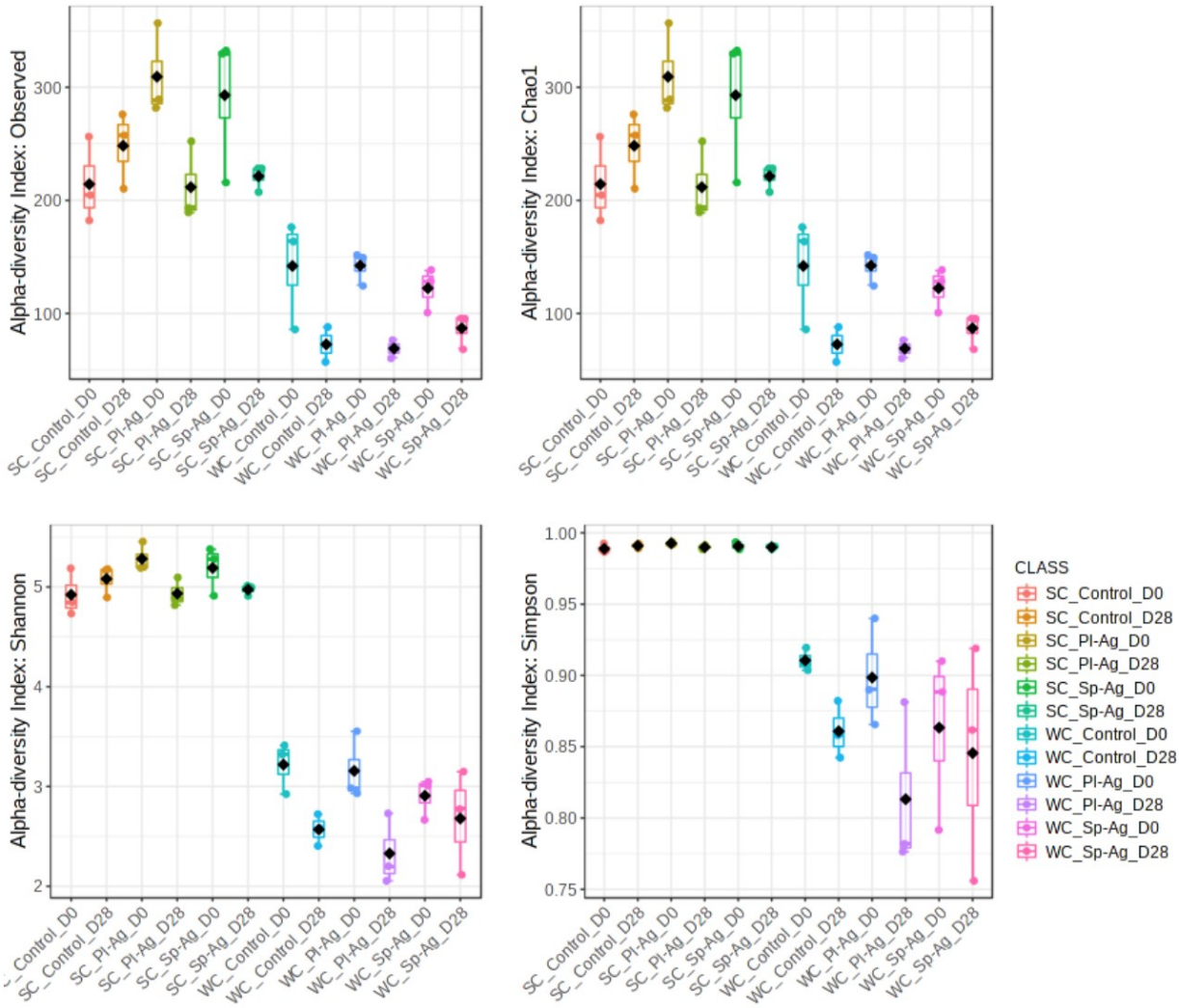


Figure S10. Alpha diversity at Day 0 and Day 28 in microbiomes from the surficial sedimentary compartment (SC) and the water column compartment (WC) of the mesocosms spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 Index, Shannon and Simpson indexes. See Table S2 for more details.

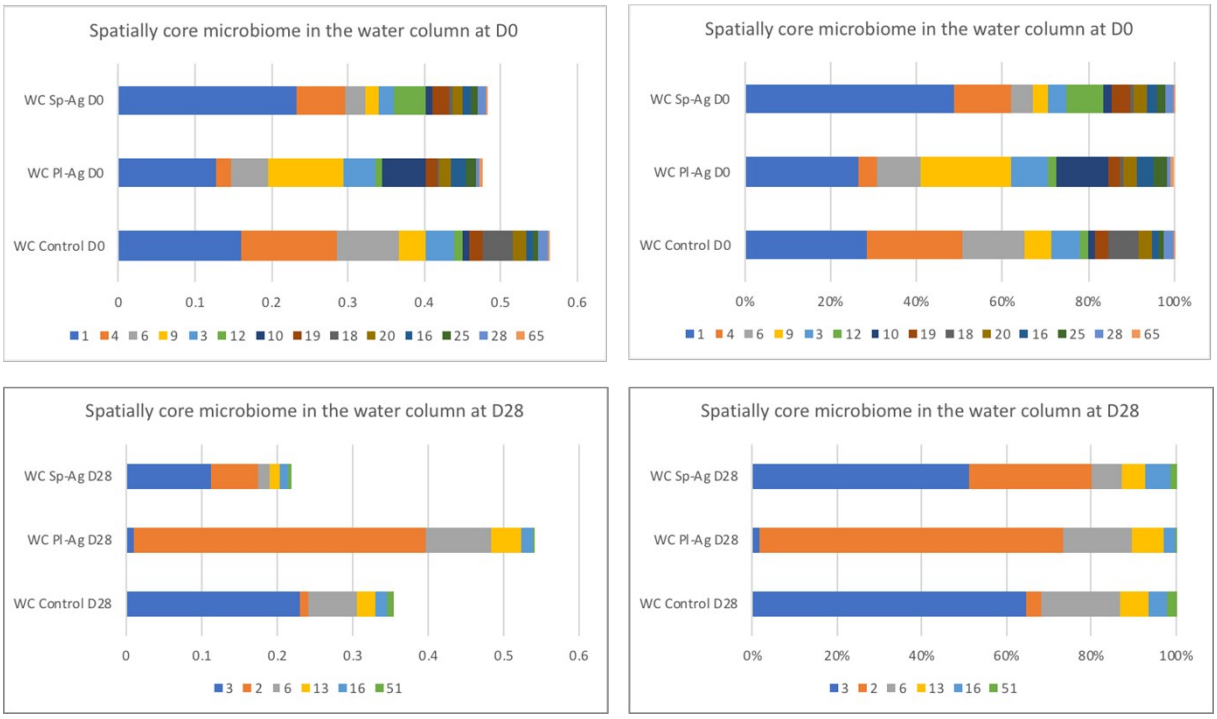


Figure S11. Relative (left) or absolute abundance (right) of the spatially persistent core microbiome at Day 0 (D0) and Day 28 (D28) in the water columns (WC) of Control, and Pl-Ag or Sp-Ag dosed mesocosms. The persistent core microbiome is defined as OTUs that are present in 80% of the samples. The different OTUs that make up this core microbiome are represented by numbers and a corresponding color in the legend of each graph.

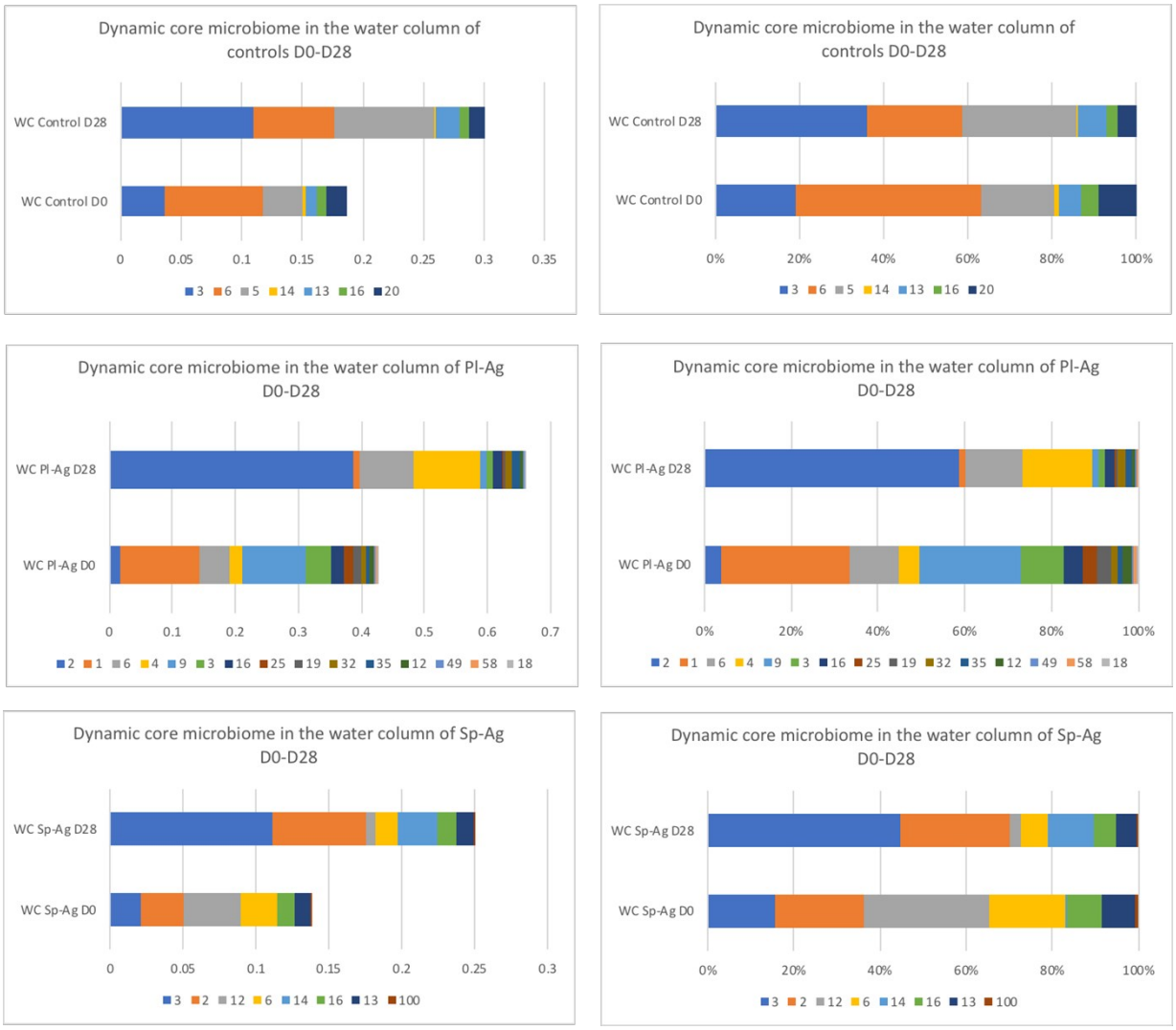


Figure S12. Relative (left) or absolute abundance (right) of the temporally persistent core microbiome between Day 0 (D0) and Day 28 (D28) in the water columns (WC) of Control, and Pl-Ag or Sp-Ag dosed mesocosms. The persistent core microbiome is defined as OTUs that are present in 80% of the samples. The different OTUs that make up this core microbiome are represented by numbers and a corresponding color in the legend of each graph.

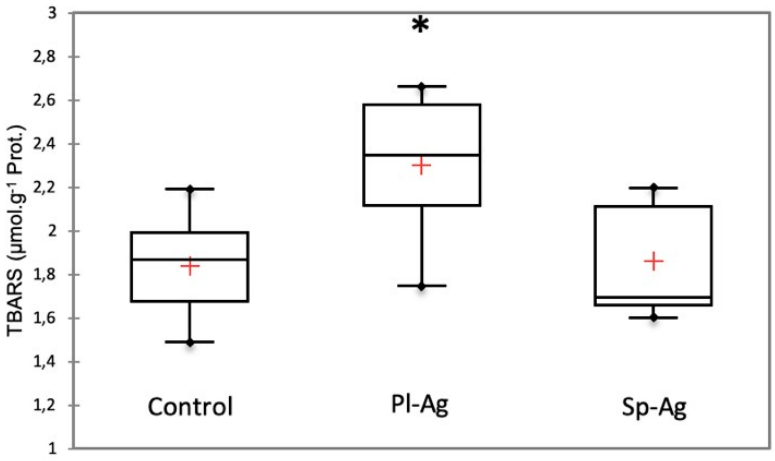


Figure S13. Box plot showing Lipid peroxidation (TBARS) in *G. fossarum* after 28 days of exposure. Red crosses are means, horizontal central bars are medians, inferior and superior limits of boxes are respectively first and third quartiles, inferior and superior vertical bars are respectively minimum and maximum values. * indicates a significant difference with the control group ($p<0.05$).

Table S1. Table of all statistical results presented in Figure S4 regarding the Alpha diversity at Day 0 in microbiomes from the surficial sedimentary compartment (SC) and the water column compartment (WC) of the mesocosms spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 Index, Shannon and Simpson Indexes.

Day-0
OBSERVED OTUS p-value: 0.013367; [Kruskal-Wallis] statistic: 14.38

Multiple pairwise comparisons using the Conover-Iman procedure / Two-tailed test:

| p-values | SC_Control_D0 | SC_Pl-Ag_D0 | SC_Sp-Ag_D0 | WC_Control_D0 | WC_Pl-Ag_D0 | WC_Sp-Ag_D0 |
|---|---|---|---|---|---|---|
| SC_Control_D0 | 1 | 0,055 | 0,097 | **0,022** | **0,017** | **0,002** |
| SC_Pl-Ag_D0 | 0,055 | 1 | 0,749 | **0,000** | **0,000** | **< 0.0001** |
| SC_Sp-Ag_D0 | 0,097 | 0,749 | 1 | **0,001** | **0,001** | **< 0.0001** |
| WC_Control_D0 | **0,022** | **0,000** | **0,001** | 1 | 0,873 | 0,215 |
| WC_Pl-Ag_D0 | **0,017** | **0,000** | **0,001** | 0,873 | 1 | 0,274 |
| WC_Sp-Ag_D0 | **0,002** | **< 0.0001** | **< 0.0001** | 0,215 | 0,274 | 1 |

Day-0
CHAO1 p-value: 0.015425; [Kruskal-Wallis] statistic: 14.029

Multiple pairwise comparisons using the Conover-Iman procedure / Two-tailed test:

| | SC_Control_D0 | SC_Pl-Ag_D0 | SC_Sp-Ag_D0 | WC_Control_D0 | WC_Pl-Ag_D0 | WC_Sp-Ag_D0 |
|---|---|---|---|---|---|---|
| SC_Control_D0 | 1 | 0,069 | 0,117 | **0,023** | **0,013** | **0,007** |
| SC_Pl-Ag_D0 | 0,069 | 1 | 0,764 | **0,001** | **0,000** | **0,000** |
| SC_Sp-Ag_D0 | 0,117 | 0,764 | 1 | **0,001** | **0,001** | **0,000** |
| WC_Control_D0 | **0,023** | **0,001** | **0,001** | 1 | 0,764 | 0,550 |
| WC_Pl-Ag_D0 | **0,013** | **0,000** | **0,001** | 0,764 | 1 | 0,764 |
| WC_Sp-Ag_D0 | **0,007** | **0,000** | **0,000** | 0,550 | 0,764 | 1 |

Day-0
SHANNON p-value: 0.016487; [Kruskal-Wallis] statistic: 13.865

Multiple pairwise comparisons using the Conover-Iman procedure / Two-tailed test:

| | SC_Control_D0 | SC_Pl-Ag_D0 | SC_Sp-Ag_D0 | WC_Control_D0 | WC_Pl-Ag_D0 | WC_Sp-Ag_D0 |
|---|---|---|---|---|---|---|
| SC_Control_D0 | 1 | 0,203 | 0,203 | **0,020** | **0,015** | **0,002** |
| SC_Pl-Ag_D0 | 0,203 | 1 | 1,000 | **0,002** | **0,001** | **0,000** |
| SC_Sp-Ag_D0 | 0,203 | 1,000 | 1 | **0,002** | **0,001** | **0,000** |
| WC_Control_D0 | **0,020** | **0,002** | **0,002** | 1 | 0,884 | 0,254 |
| WC_Pl-Ag_D0 | **0,015** | **0,001** | **0,001** | 0,884 | 1 | 0,316 |
| WC_Sp-Ag_D0 | **0,002** | **0,000** | **0,000** | 0,254 | 0,316 | 1 |

Day-0
SIMPSON p-value: 0.017288; [Kruskal-Wallis] statistic: 13.749

Multiple pairwise comparisons using the Conover-Iman procedure / Two-tailed test:

| | SC_Control_D0 | SC_Pl-Ag_D0 | SC_Sp-Ag_D0 | WC_Control_D0 | WC_Pl-Ag_D0 | WC_Sp-Ag_D0 |
|---|---|---|---|---|---|---|
| SC_Control_D0 | 1 | 0,168 | 0,477 | **0,021** | **0,007** | **0,002** |
| SC_Pl-Ag_D0 | 0,168 | 1 | 0,477 | **0,001** | **0,001** | **0,000** |
| SC_Sp-Ag_D0 | 0,477 | 0,477 | 1 | **0,005** | **0,002** | **0,001** |
| WC_Control_D0 | **0,021** | **0,001** | **0,005** | 1 | 0,568 | 0,263 |
| WC_Pl-Ag_D0 | **0,007** | **0,001** | **0,002** | 0,568 | 1 | 0,568 |
| WC_Sp-Ag_D0 | **0,002** | **0,000** | **0,001** | 0,263 | 0,568 | 1 |

Table S2. Table of all statistical results presented in Figure S10 regar microbiomes from the surficial sedimentary compartment (SC) and the water column c spiked with Pl-Ag and Sp-Ag and the controls based on observed OTUs richness, Chao1 s.

| -Ag_D28 | WC_Sp-Ag_D0 | WC_Sp-Ag_D28 |
|---|---|---|
| < 0.0001 | 0,002 | < 0.0001 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | 0,003 | < 0.0001 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | 0,000 | < 0.0001 |
| 0,002 | 0,664 | 0,060 |
| 0,913 | 0,005 | 0,137 |
| 0,004 | 0,828 | 0,091 |
| 1 | 0,007 | 0,166 |
| 0,007 | 1 | 0,137 |
| 0,166 | 0,137 | 1 |

| /C_Pl-Ag_D28 | WC_Sp-Ag_D0 | WC_Sp-Ag_D28 |
|---|---|---|
| < 0.0001 | 0,001 | 0,000 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | 0,001 | 0,000 |
| < 0.0001 | < 0.0001 | < 0.0001 |
| < 0.0001 | 0,000 | 0,000 |
| 0,004 | 0,256 | 0,113 |
| 0,632 | 0,134 | 0,297 |
| 0,008 | 0,392 | 0,188 |
| 1 | 0,053 | 0,134 |
| 0,053 | 1 | 0,632 |
| 0,134 | 0,632 | 1 |

[Kruskal-Wallis] statistic: 29,324

over-Iman procedure / Two-tailed test:

| SC_Control_D28 | SC_Pl-Ag_D0 | SC_Pl-Ag_D28 | SC_Sp-Ag_D0 | SC_Sp-Ag_D28 | WC_Control_D0 | WC_Control_D28 | WC_Pl-Ag_D0 | WC_Pl-Ag_D28 | WC_Sp-Ag_D0 | WC_Sp-Ag_D28 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0,349 | 0,049 | 0,694 | 0,433 | 0,753 | 0,030 | 0,000 | 0,008 | < 0.0001 | 0,002 | 0,001 |
| 1 | 0,276 | 0,582 | 0,875 | 0,530 | 0,003 | < 0.0001 | 0,001 | < 0.0001 | 0,000 | 0,000 |
| 0,276 | 1 | 0,107 | 0,215 | 0,092 | 0,000 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 |
| 0,582 | 0,107 | 1 | 0,694 | 0,937 | 0,012 | 0,000 | 0,003 | < 0.0001 | 0,001 | 0,000 |
| 0,875 | 0,215 | 0,694 | 1 | 0,637 | 0,005 | < 0.0001 | 0,001 | < 0.0001 | 0,000 | 0,000 |
| 0,530 | 0,092 | 0,937 | 0,637 | 1 | 0,015 | 0,000 | 0,004 | < 0.0001 | 0,001 | 0,001 |
| 0,003 | 0,000 | 0,012 | 0,005 | 0,015 | 1 | 0,068 | 0,582 | 0,025 | 0,244 | 0,188 |
| < 0.0001 | < 0.0001 | 0,000 | < 0.0001 | 0,000 | 0,068 | 1 | 0,188 | 0,637 | 0,480 | 0,582 |
| 0,001 | < 0.0001 | 0,003 | 0,001 | 0,004 | 0,582 | 0,188 | 1 | 0,079 | 0,530 | 0,433 |
| < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | 0,025 | 0,637 | 0,079 | 1 | 0,244 | 0,311 |
| 0,000 | < 0.0001 | 0,001 | 0,000 | 0,001 | 0,244 | 0,480 | 0,530 | 0,244 | 1 | 0,875 |
| 0,000 | < 0.0001 | 0,000 | 0,000 | 0,001 | 0,188 | 0,582 | 0,433 | 0,311 | 0,875 | 1 |