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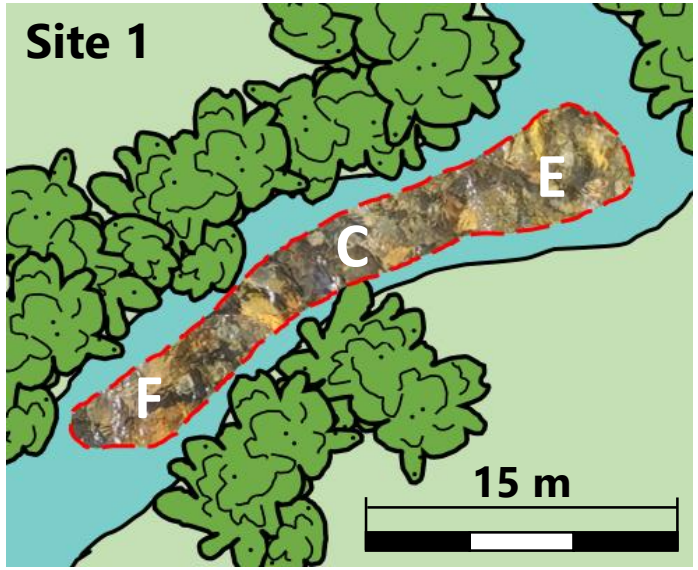
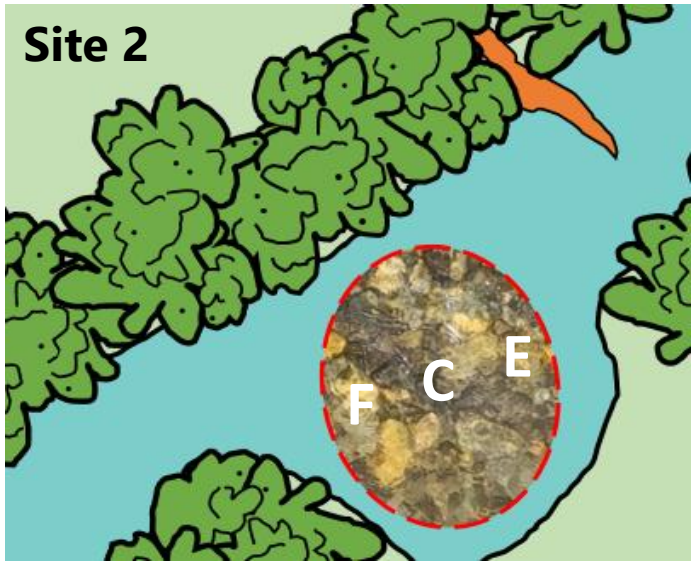
A depth-resolved snapshot of microplastic abundance in riffle heads of a gravelbed river

Microplastic in a fluvial sedimentary perspective





- Retained in riverbed sediments

  → Even deeper layers affected*

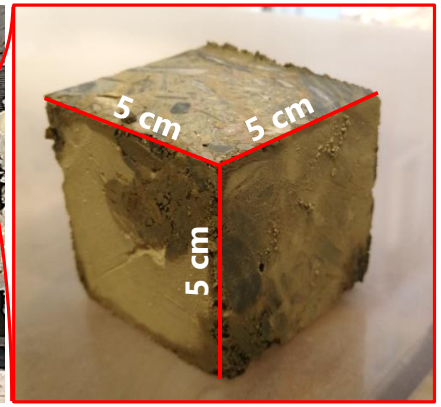
- Depth-profiled microplastic distribution insufficiently described for sediments of river systems

Hypothesis: Geomorphological features of riverbeds affect microplastic depth distribution profiles

→ Snapshots of six freeze-cores from gravelbed riffles

* Frei et al. (2019); Mani et al. (2019); Nui et al. (2021); Zhou et al. (2021)

Methodological procedure

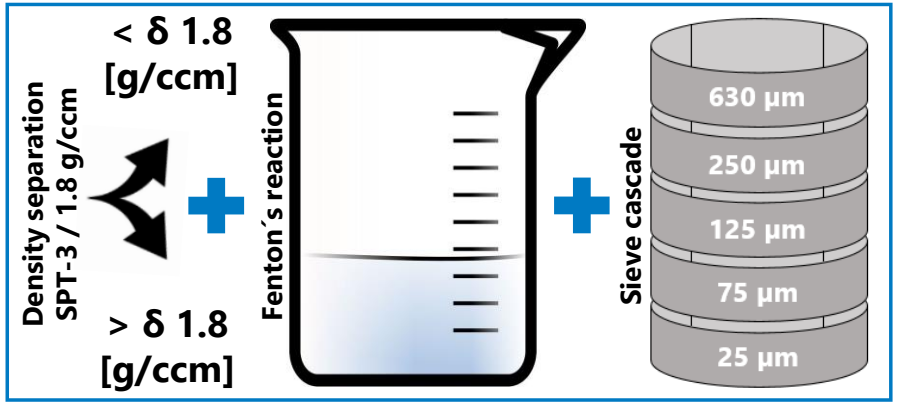


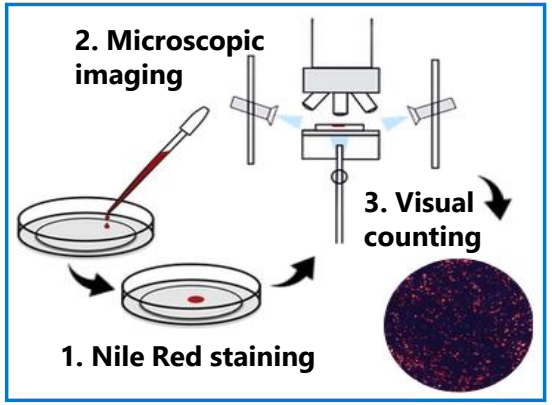
Freeze-core extraction from two riffles

Sediment Cube Sample (SCS)

Laboratory pre-treatment

Raman Spectroscopy & Nile Red staining





Measurement campaign	Raman	Nile Red
Freeze-cores	2	6
Riffle position	C	F, C, E
Depth segments	10	10
Sediment cube samples	20	60
Subsamples	100	300
Total microplastics items	4263	4714
Total sample volume [ccm]	250	750
Total sample weight [KG]	0.44	1.42

Sediment morphological features		
Ø Porosity [%]	24.43	24.82
Ø Matrix density [g/ccm]	2.60	2.69

Abbreviations	
Grain size	GS
Microplastic	MP
Nile Red	NR
Front position	F
Centre position	C
End position	E

Overall Raman-based results

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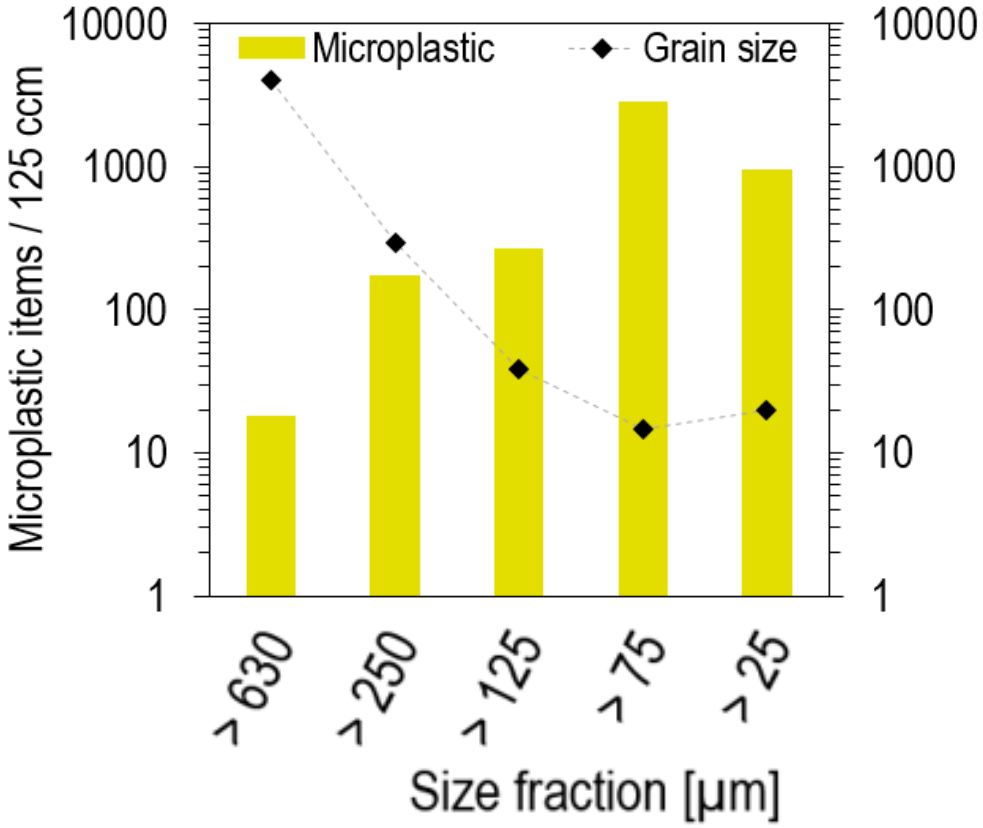
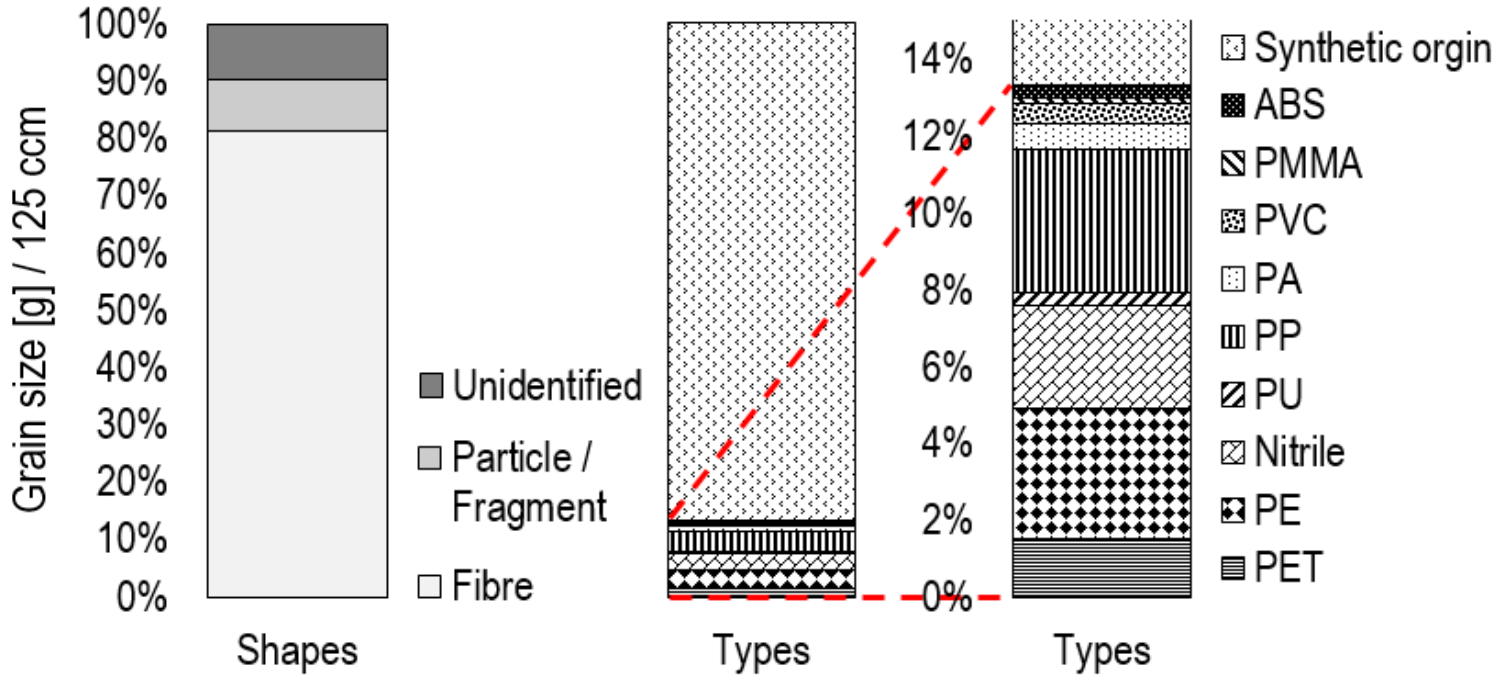
Microplastic vs. Grain size

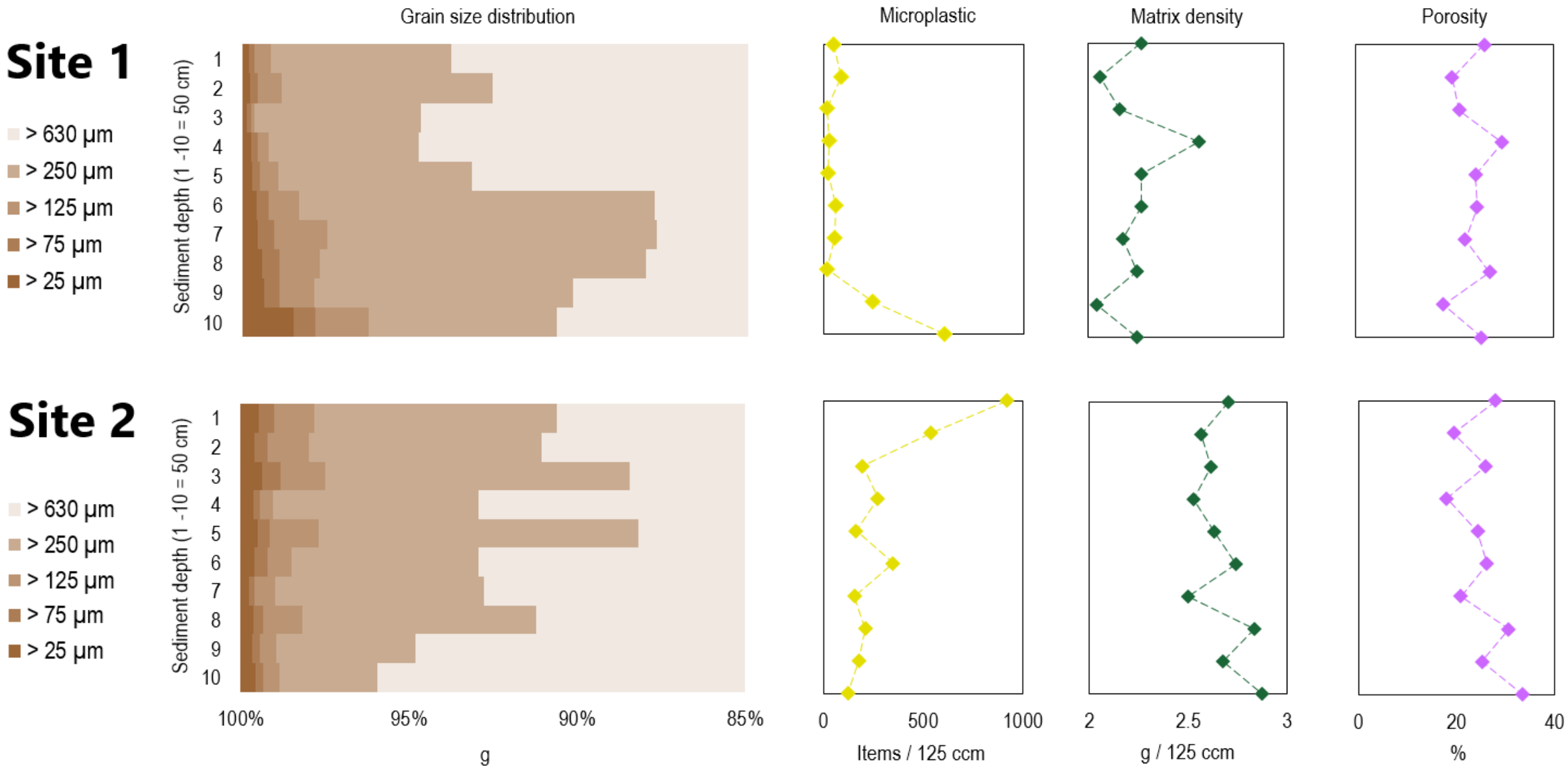


Microplastic specifications: Shape & type



→ Overall qualitative and quantitative results of two freeze-cores from the centre positions (site 1 and site 2) based on Raman data

Morphological features and microplastic



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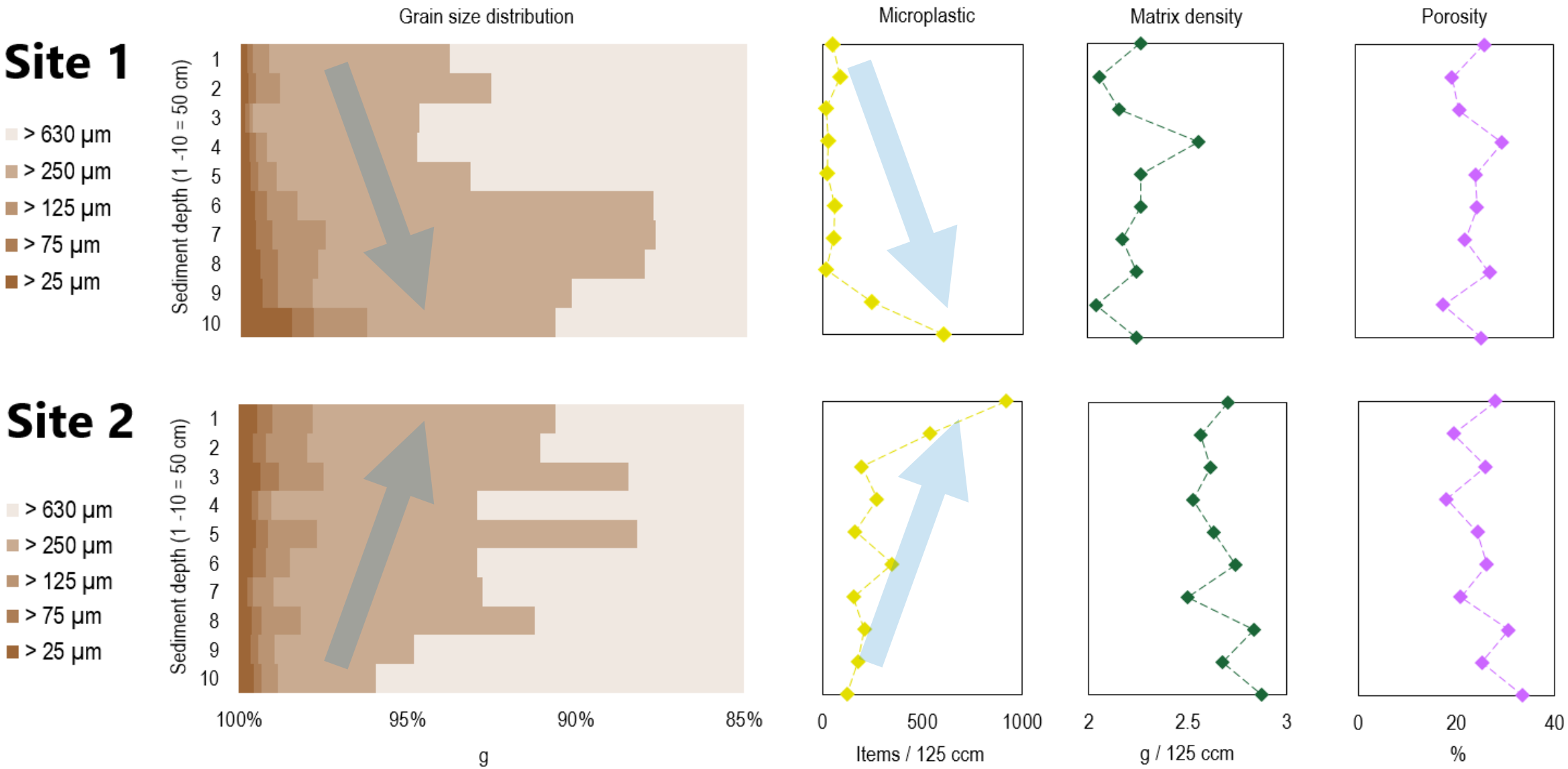
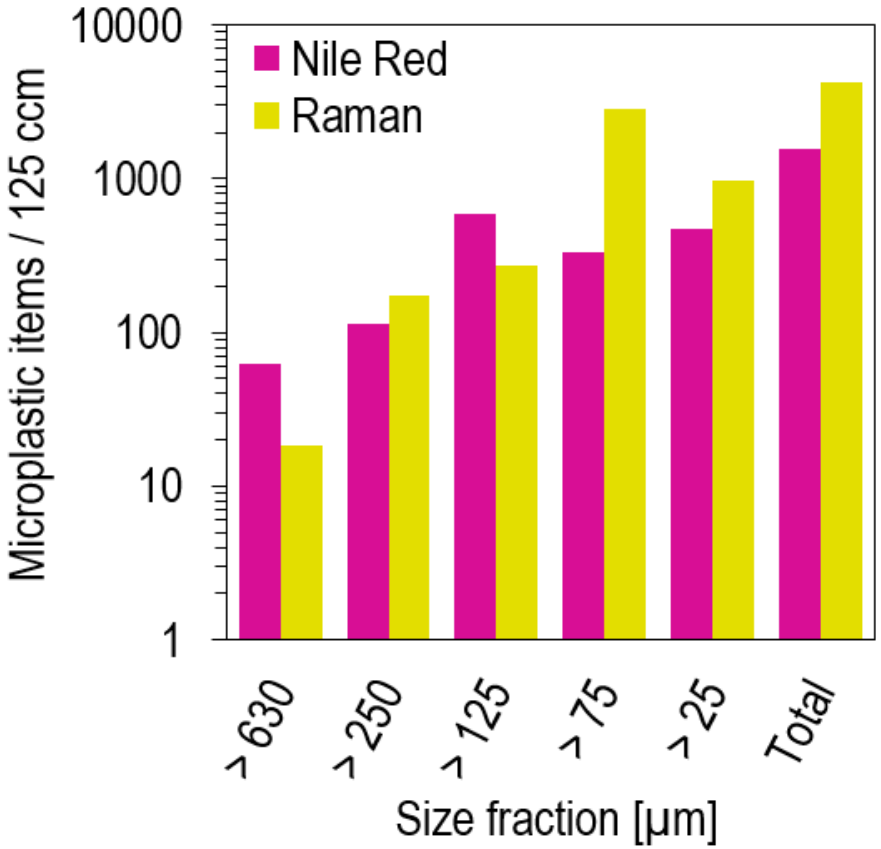


Data comparison: Raman vs. Nile Red



- Nile Red data show similar results in the overall abundance
- Two large deviations:
  - > 630 µm = Caused by non-degraded organic matter
  - > 75 µm = Caused by non-detected synthetic fibres

→ Comparison between Raman and Nile Red data of two freeze-cores from the centre positions (site 1 and site 2)

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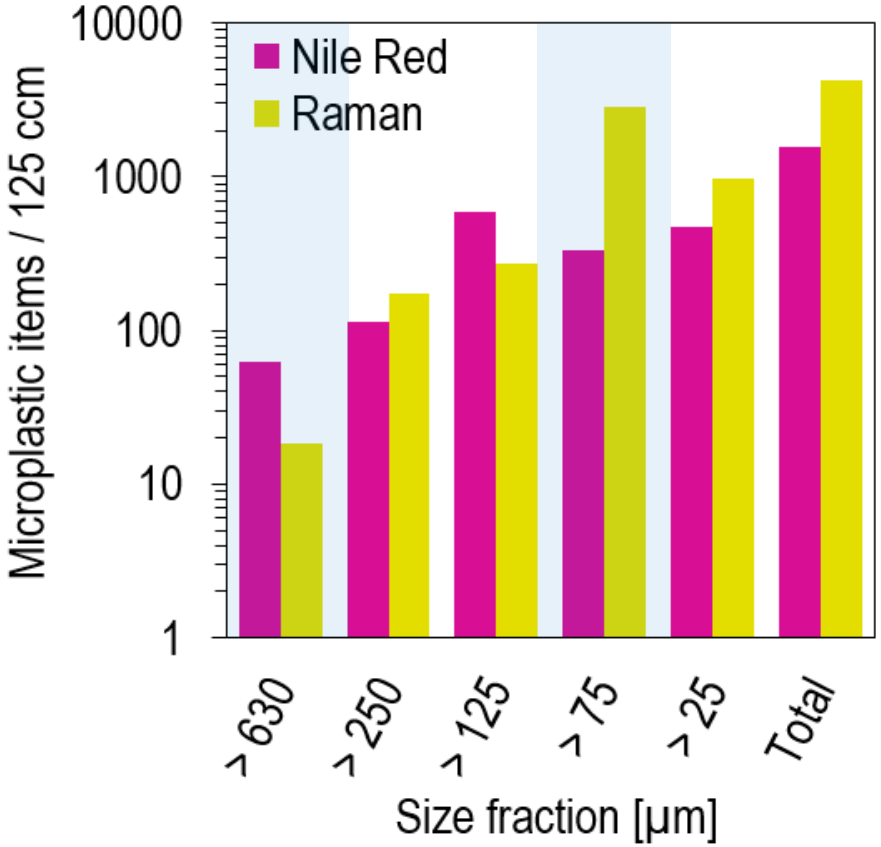

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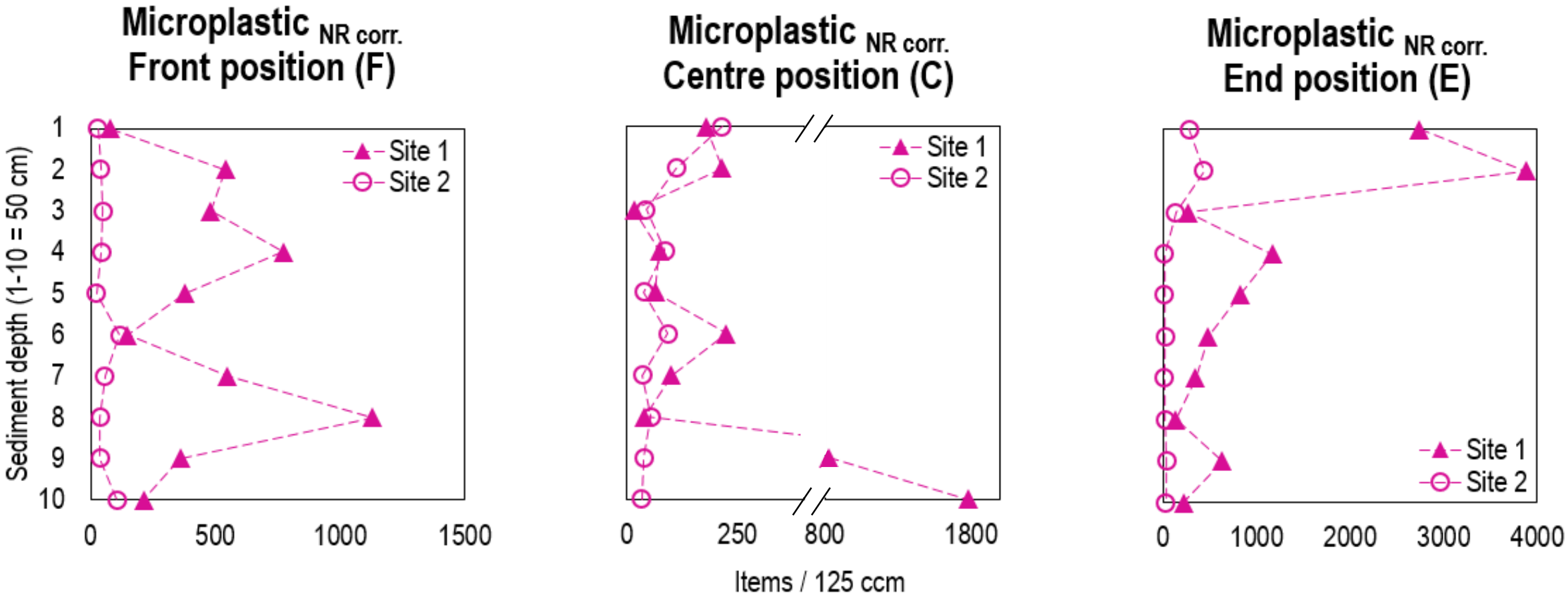
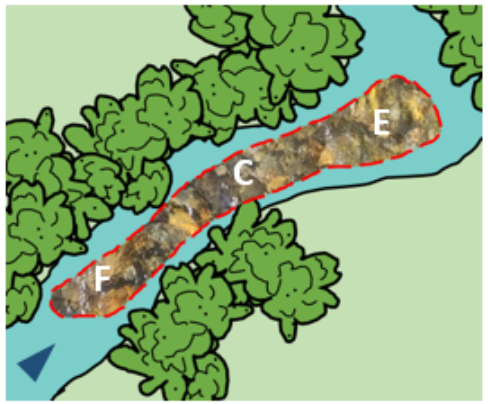
Position-dependent microplastic depth profiles



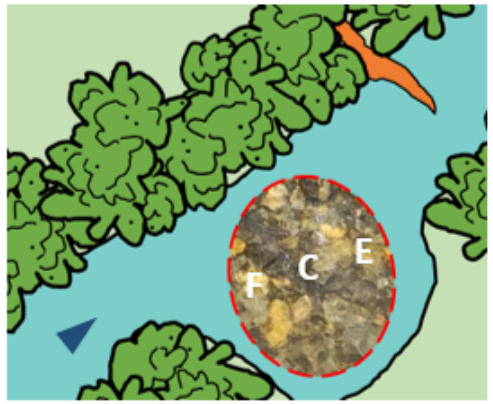
→ Corrected Nile Red data of six freeze-cores from three positions (F, C, E) at site 1 and site 2

Depth-profiled grain size and microplastic…



Site 1

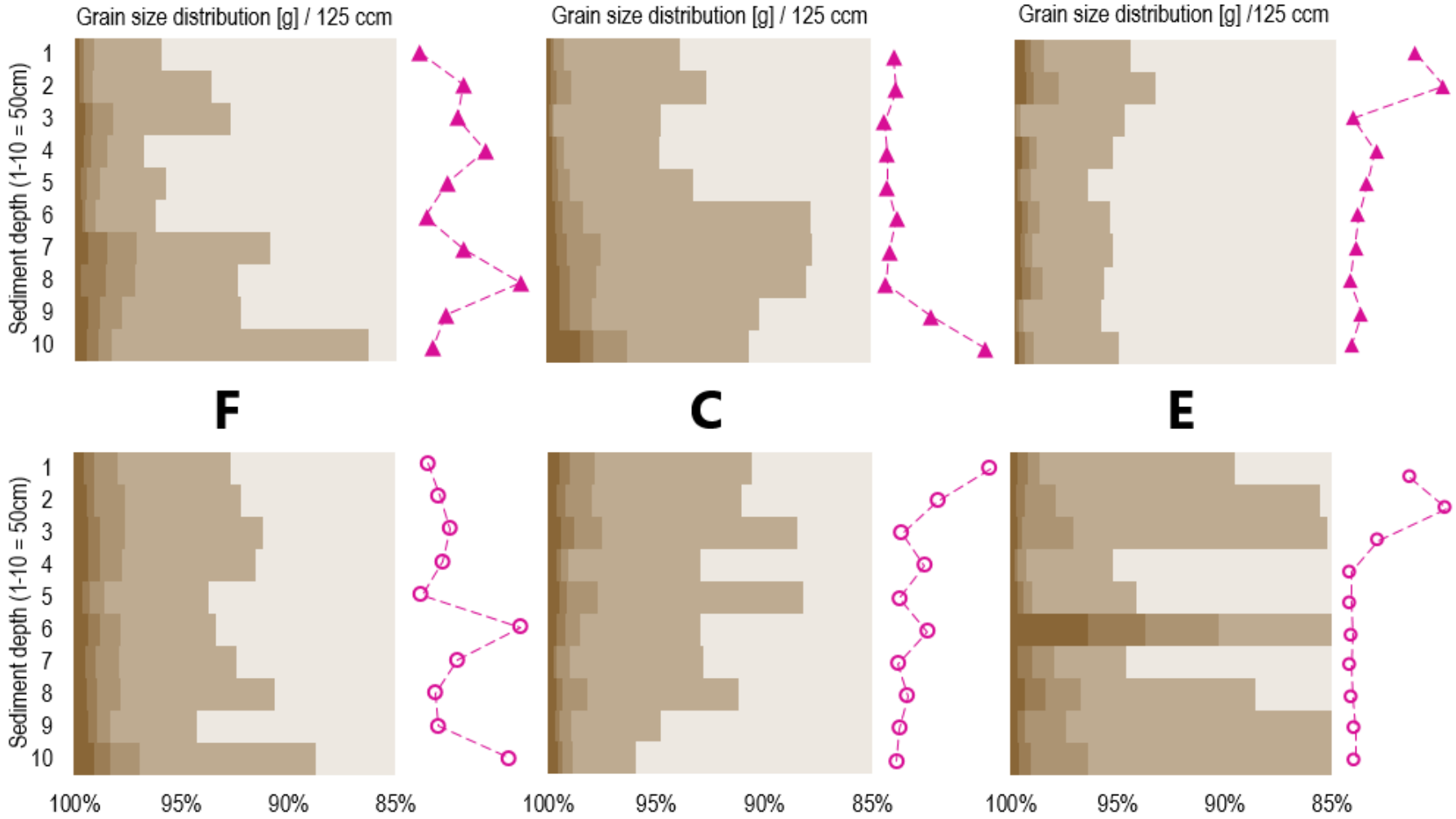
- > 630 µm
- > 250 µm
- > 125 µm
- > 75 µm
- > 25 µm
- MP depth profile



Site 2

- > 630 µm
- > 250 µm
- > 125 µm
- > 75 µm
- > 25 µm
- MP depth profile

= Flow direction



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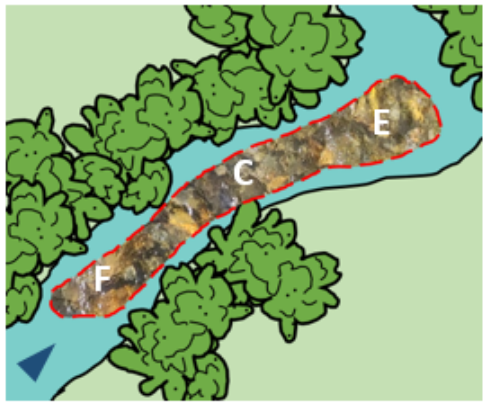

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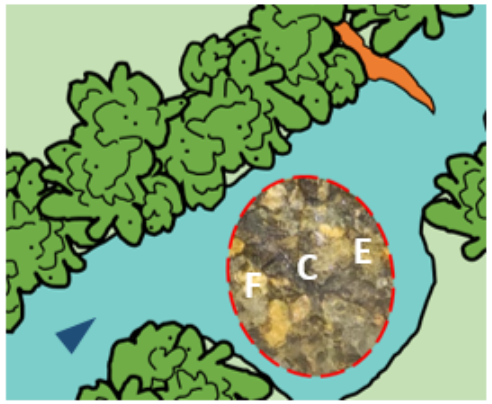

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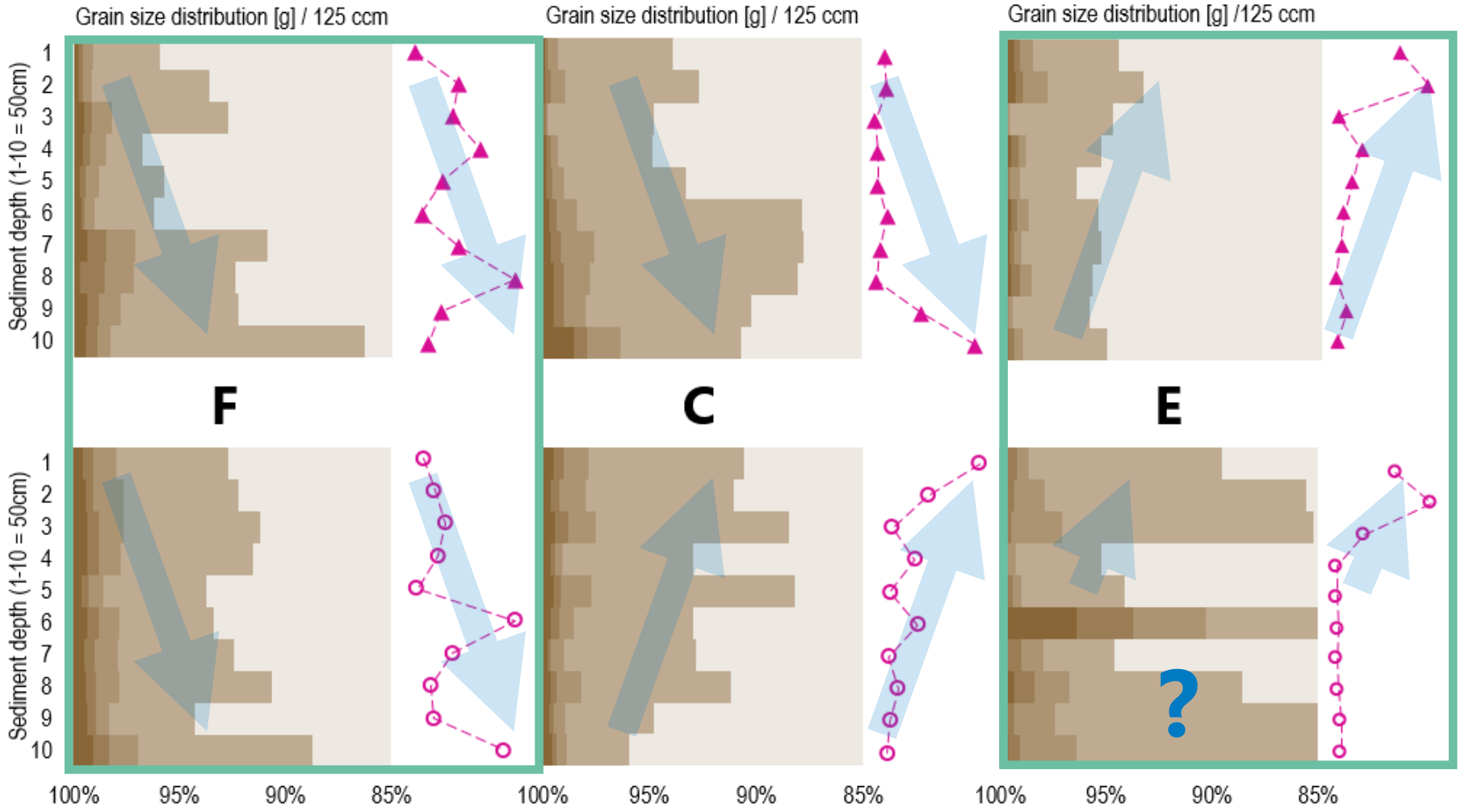

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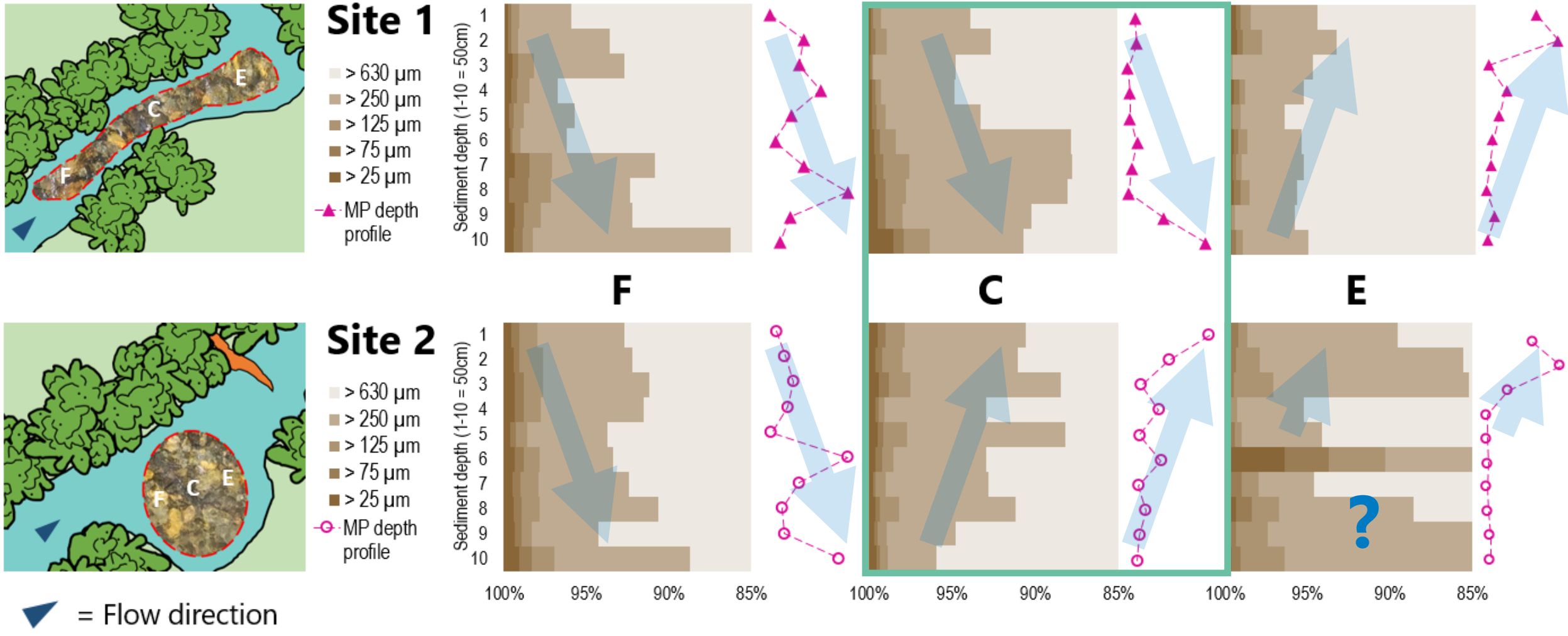

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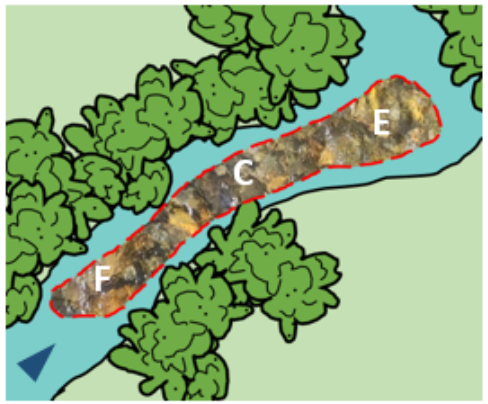

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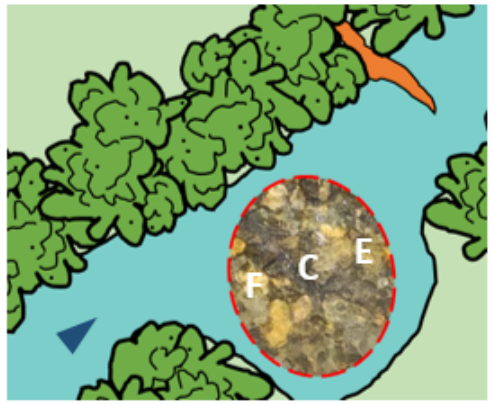

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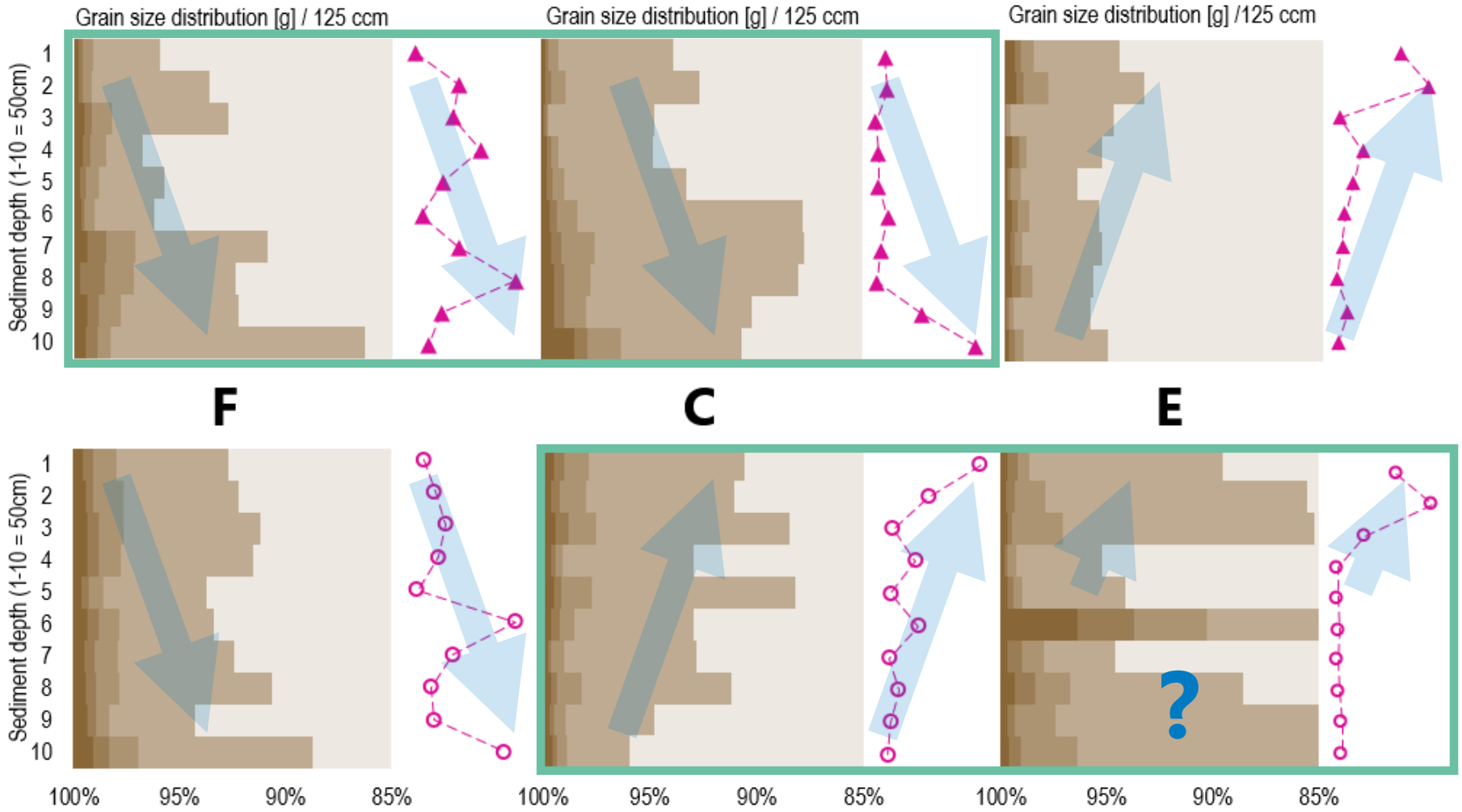

… keep in mind!

- Riffle position affects depth profile distributions of microplastic
- Depth profiles of the riffles in the geometric centre (C) can show front position (F) similarities or end position (E) similarities
- Spatial extent of riffles might influence depth profile distributions of microplastic
- More studies needed to validate the data

Thank you for your attention!