Your goal is accurately determining nanoplastic concentration in the sample given. For that you are responsible for 2 themes: Looking at microplastic concentration as a proxy for nanoplastics and how to deal with other organic compounds that the machine can't differentiate.

3. What is the concentration of microplastics in this region, as an indication of the increase in nanoplastic concentration.

Q: Are they linearly related?

Q: Do NPs in sediment come from degradation of MPs (so total weight = constant)?

Q: Does degradation of MPs occur at those depths?

Q: What is the most important factor in MP degradation?

A: UV + trauma and microbes

Q: Do nanoplastics precipitate on their own in significant amounts?

Q: Do NPs precipitate on the seabed?

A: NP behave like colloids and do not precipitate in significant amounts

Q: Do they precipitate mostly by binding to heavier particles who precipitate?

A: NPs aggregate to themselves and specks and as a result sink due to their weight.

It was found that microplastic concentration is not a valid approximation for nanoplastic concentration. Microplastics arrive at the sea floor with different mechanisms and therefore do not have an exact relation to nanoplastics. Microplastics behave like particles and are capable of sinking. Nanoplastics behave like colloids and do not sink quickly, unless they (self)aggregate. The aggregates are too big to pass through the less porous filters. This can lead to significant loss of nanoplastics in the sample. The aggregates can be destroyed using sonication.

I would like this to work thank you very much

4. Amounts of detritus, and whether this would contaminate the measurement

Q: What is detritus concentration in the surrounding water?

Q: What is its precipitation rate?

Q: Is detritus of bottom dwellers or carcasses concentrated on the seafloor significant?

Q: How do you account for the signals of detritus?

A: Filter detritus beforehand so only NP are measured?

Q: How to filter just the detritus?

A: Enzymatic treatment to destroy only biodegradable compounds

Q: Subtract detritus concentration (average) from concentration of NP?

A: A very crude method, not suitable to quantitative analysis we do

Q: Do we need to account for detritus signals?

Detritus is present on the seafloor, as it is everywhere in the ocean. Detritus is also one of the things that the nanoplastics can aggregate on. As the aggregates are dispersed using sonication and afterwards the supernatant is filtered only very low mass organic compounds should remain in solution. These typically have a low boiling point so should not be detected at the same time as the nanoplastics (high boiling point). If they do somehow come along with the nanoplastics (if the nanoplastics aggregate to them again during the rise in temperature perhaps) then their MS footprints should be sufficiently different as to not warrant any concern.

Considering the sources I found, it seems that bioproduction of NPs at depth is real and non-negligible, but only a fraction of the concentration (though no paper has in situ results for this). Considering that mechanical, bio- and especially photodegradation at the surface in combination with a higher concentration of plastics at the surface lead to more NP production. Vertical transport of NPs should account for the majority of NP concentration in the water above the seabed. Even accounting for slow vertical transport.

At deeper waters there is reduced current speed as induced by wind. That combined with low NP production from mechanical stress alone as well as less biodegradation should lead to negligible NP production at greater depths.

There is a lot of NP production at the surface. It has 5 things not found at greater depths. High plastic amounts, mechanical stress, UV radiation, amount of microbes and high temperature. Leaving the first aside, in order to get any NP production we seem to need either microbes (preferably at higher temperatures) or mechanical stress (greatly improved by UV-radiation). None of the five are readily found at the bottom of the ocean which leads me to conclude that there is little NP production at greater depths and any NP present is transported there.

Bronnen:

[Salinity correlates with microplastic concentration in surface samples. Microplastic concentration correlates negatively with distance to coast.](https://www.sciencedirect.com/science/article/pii/S0025326X24011949)

[Qualitative assessment of NP concentration from ~ 2 cm^2 PS with only UV/Vis exposure.](https://www.sciencedirect.com/science/article/pii/S0045653515304094?via%3Dihub)

[Simulated NP generation using sterile seawater and mechanical and photodegradation. Found that NP concentration (PS and PE-PP) was significantly higher with mechanical and photodegradation than with only mechanical fragmentation. Attributed to few micron plastics being formed by mechanical strain and subsequently fragmented by UV radiation into NPs.](https://www.sciencedirect.com/science/article/pii/S0048969722015315)

[2 Species of deep sea bacteria can fragment PS to significant amounts of MNP in 30 days at high concentration of both PS and bacteria and at high temperature and (presumably) not in darkness.](https://www.sciencedirect.com/science/article/pii/S0304389423026237)

[(marine) Surface plankton generate a lot of NPs from photodegradated MPs.](https://www.nature.com/articles/s41565-023-01534-9)

[Describes the fragmentation of MPs to NPs by mechanical means during wastewater treatment](https://www.sciencedirect.com/science/article/pii/S026974912402027X)

[Quantitative analysis of MP sinking in the Southern Ocean.](https://www.sciencedirect.com/science/article/pii/S0025326X23005490?via%3Dihub)

[MPs discovered in deep waters. Concentration is negatively correlated with depth. Which is incompatible with the idea that MPs only sink.](https://www.sciencedirect.com/science/article/pii/S0025326X24007185?via%3Dihub)

[NPs behave like colloids. Once they aggregate they behave like particles. Compares models and reviews their environmental relevancy.](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0330)

“With decreasing size, particles transition away from motion dictated by gravitational forces (i.e., macro- to [microparticle](https://www.sciencedirect.com/topics/materials-science/microparticle) behavior) and towards motion dictated by Brownian motion and [intermolecular forces](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/intermolecular-force) (i.e., colloidal behavior) ([Elimelech, 1998](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0225); [Hiemenz and Rajagopalan, 1997](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0330)). The transition to Brownian motion in water occurs when carbon-based particles are smaller than ∼1 μm ([Hiemenz and Rajagopalan, 1997](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0330)). Given a favorable (attractive) balance of surface interactions and [hydrodynamic](https://www.sciencedirect.com/topics/materials-science/hydrodynamics) forces, nanoplastics sorb onto particles and/or molecules. The increase in dimension caused by the [sorption](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/sorption) of such species onto nanoplastics can cause them take on a gravity-driven motion again, the same as larger particles. Therefore, the colloidal stability of nanoplastics (i.e., their capacity to remain dispersed) is the primary determinant of their [environmental fate](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-fate) ([Filella, 2007](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0255); [IUPAC, 1997](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0370); [Stumm and Morgan, 1996](https://www.sciencedirect.com/science/article/pii/S2452074823000046" \l "bb0805)), and the focus of this review.“

[Using heavy stirring and sonication can break apart aggregates of nanoplastics. The paper further reviews different circumstances and their effect on aggregation and nanoplastic migration.](https://www.sciencedirect.com/science/article/pii/S0043135424012983)

J.E. McMurray, Organic Chemistry, 9th Ed., p. 79.. Organic compounds increase in BP with higher molecular mass.

<https://www.masterorganicchemistry.com/2010/10/25/3-trends-that-affect-boiling-points/>

Mass is not the only thing influencing BP. Here are some more.

[Many atmospheric VOCs have a unique pattern. Applications of PTRMS to atmospheric samples.](https://pubs.acs.org/doi/10.1021/acs.chemrev.7b00325)

Conclusion:

The nanoplastics we detected deeper in the sediment could not have been deposited during the formation of those sediment layers. We must therefore conclude that they were brought there by a perturbation. Wether this was by biological, geophysical or human means (during the procurement of the sediment) we cannot say.

We do not know why PVC specifically seems to be more likely to be transported deeper into the sediment. PS accounts for a disproportionate fraction of the nanoplastics found in the top layer of the sediment. This could indicate a higher likelihood for PS to aggregate.