Anthropocene plastics stratigraphy and ubiquitous microplastics as anthropogenic sedimentary particles in alpine rivers

Michael WAGREICH[1)], Paris KONSTANTINIDES, Mario BUBL

Department of Geodynamics and Sedimentology

1. Introduction

The Anthropocene as a potential geological time unit has been widely discussed since (*Crutzen, 2000*) proposed the term for the first time. The Anthropocene Working Group suggests the base of a chronostratigraphic Anthropocene to be around the 1950s. The geological record around the „Great Acceleration" - a time when human impacts on geological processes become evident - shows not only distinct geochemical signals but also a change in sedimentary materials including anthropogenic matter.

First appearing in the mid 20th century, plastics have found their way into almost all environments around the globe. Research on ist distribution in the terrestrial and marine environments suggest that plastic has become a key indicator for the Anthropocene as a stratal component (*Zalasiewicz et al. 2016*; See figure below). Both macro- and especially microplastics (<5mm) are widespread to the point that it is already practically impossible to avoid them and their amount seem likely to grow exponentially.

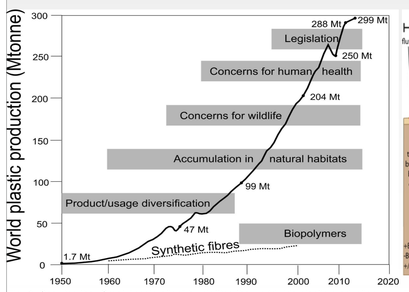


Fig. 1: Showing the „Great Acceleration" by plotting the worldwide plastic production. (Zalasiewicz et al. 2016)

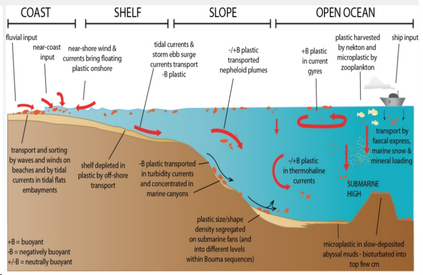


Fig. 2: The conceptual model of the transport and accumulation of microplastics in the marine realm. (Zalasiewicz et al. 2016)

For better understanding on how microplastics behave and where these particles deposit, research on their distribution in the sediments of two alpine rivers - Triesting (Lower Austria) and Alz (Bavaria) - have been conducted.

Fig. 3: The aproximate location of both rivers. (Online: Europakarte.org)

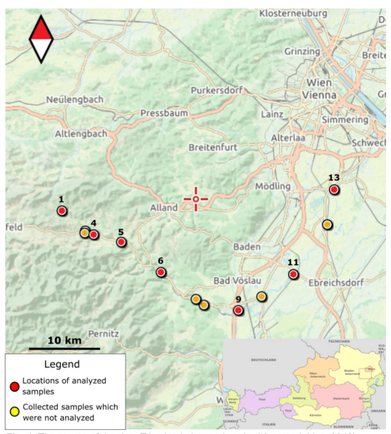


Fig. 4: The course of the river Triesting in Lower Austria. (Konstantinides, 2018)

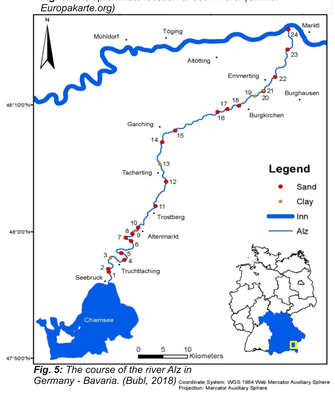


Fig. 5: The course of the river Alz in Germany - Bavaria. (Bubl, 2018)

[1)] Department for Geodynamics and Sedimentology, University of Vienna, Althanstrasse 14, 1090 Vienna

2. Results

2.1 Triesting

Fig. 6: Triesting at location 5, looking to the WNW. (Konstantinides, 2018)

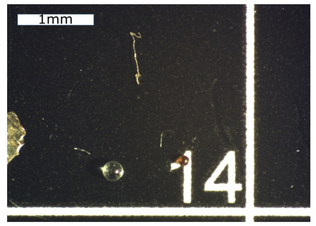
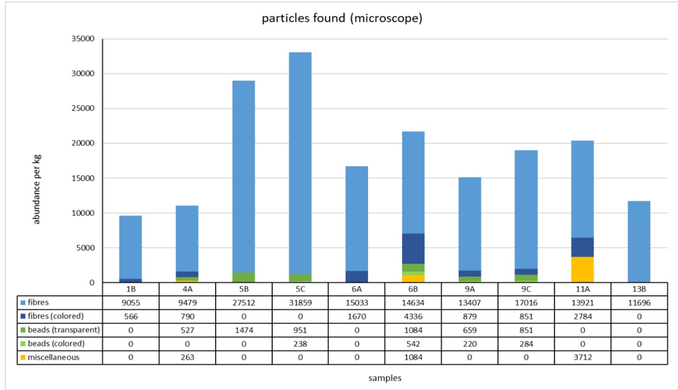


Fig. 7: Microbeads and fibre from sample 9c. (Konstantinides, 2018)



	1B	4A	5B	5C	6A	6B	9A	9C	11A	13B
fibres	9055	9479	27512	31859	15033	14634	13407	17016	13921	11696
fibres (colored)	566	790	0	0	1670	4336	879	851	2784	0
beads (transparent)	0	527	1474	951	0	1084	659	851	0	0
beads (colored)	0	0	0	238	0	542	220	284	0	0
miscellaneous	0	263	0	0	0	1084	0	0	3712	0

Fig. 8: Diagram showing all artificial particles found in the different samples, extrapolated to 1 kg dry sediment. (Konstantinides, 2018)

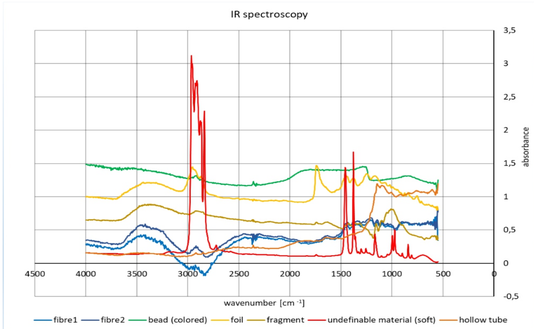


Fig. 9: Measured IR spectra from different particles. (Konstantinides, 2018)

2.2 Alz

Fig. 10: River Alz (Bubl, 2018)

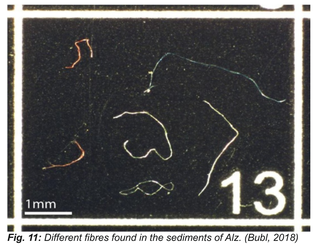


Fig. 11: Different fibres found in the sediments of Alz. (Bubl, 2018)

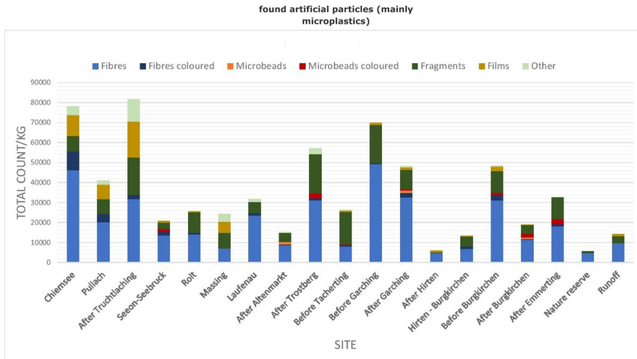


Fig. 12: Diagram showing all artificial particles found in the sediments of Alz, extrapolated to 1 kg dry sediment. (Bubl, 2018)

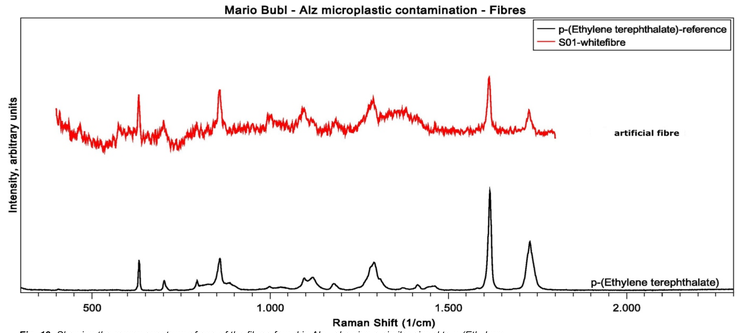


Fig. 13: Showing the raman spectrum of one of the fibres found in Alz - showing a similar signal to p-(Ethylene terephthalate). (Bubl, 2018)

All the results from both Triesting and Alz have been extrapolated to 1 kg dry sediment so that both can be compared to one another and related to other studies.
The vast majority of the material found are fibres. The rest consists of micro-beads, fragments and films.
Both riversediments seem to display a significant contamination by microplastics with a maximum amount of about 33.000 particles (Triesting) and 80.000 particles (Alz) per kg dry sediment. (*Konstantinides, 2018 and Bubl, 2018*)

3. Conclusion

By now, microplastics are a significant component of river sediments regardless of the proximity to human settlements/cities/factories. Although the amount varies in our study, they are found in every sample location along the river course, which makes them a suitable marker for the Anthropocene.

It is essential to implement simple and standardized methods as well as official guidelines, to make different surveys internationally comparable to each other.

References:

Bubl M., Wagreich, M. (2018). Sedimentary microplastic contamination in a Bavarian river system - Alz. bachelor's thesis; Univ. Vienna

Crutzen, P.J. and Stoermer, E.F. (2000). The "Anthropocene". Global Change Newsletter, 41, 17.

Konstantinides, P., Wagreich, M. (2018). Untersuchung der Mikroplastik-Kontamination im Sediment des Flusses Triesting/NÖ. bachelor's thesis; Univ. Vienna

Zalasiewicz, J., Waters, C., Ivar do Sul, J., Corcoran, P., Barnosky, A., Cearreta, A., Edgeworth, M., Galuszka, A., Jeandel, C., Leinfelder, R., Mcneill, J., Steffen, W., Summerhayes, C., Wagreich, M., Williams, M., Wolfe, A., Yonan, Y. (2016). The geological cycle of plastics and their use as a stratigraphic indicator of the Anthropocene. Anthropocene. 13.10.1016/j.ancene.2016.01.002.

(Online: www.europakarte.org <28.03.2019>)