Koukal, Veronika[1,2]; Lee, Eun Young[2]; Roudbar, Samuel[2]; Wagreich, Michael[2]

FT-IR microplastics identification in natural sediments of Austria and the Republic of Korea – introduction and first results

[1]Geological-Paleontological Department, Natural History Museum Vienna, Austria;
[2]Department of Geology, University of Vienna, Austria;
veronika.koukal@nhm-wien.ac.at

Plastics became a very abundant novel material since the late 19th century, with a significant increase in production and diversity starting from the 1950s CE onwards. Today, plastics, and especially microplastics (MP), are found almost everywhere around us, including remote places like the deep sea, isolated lakes, glaciers, and even within the human body. MP has also been proposed as a secondary marker for the stratigraphic Anthropocene and was detected in numerous geological sections suggested for the Global Stratopoint and Section (GSSP) by the ISC Anthropocene Working Group. Nevertheless, a standardized definition of the size and shape classification of polymer particles is still missing, although several established size classification schemes do exist, commonly defining the size class boundaries of MP in geosciences between 1 µm to 5 mm. MP, either manufactured as small polymer particles (primary MP) or fragmented by degradation of larger plastic litter pieces (secondary MP), are nowadays noticed as an environmental pollutant and studied by a broad range of disciplines worldwide.

In contrast to the initial attempts of MP identification in natural sediments, where particles were determined and counted by visual criteria using a stereo-microscope, the identification of polymer types has become essential. This is often accomplished by destructive thermoanalytical methods, such as pyrolysis gas chromatography-mass spectrometry or thermal desorption gas chromatography-mass spectrometry. To avoid the loss of sample material, non-destructive vibrational spectroscopic identification techniques, like Fourier transform infrared spectroscopy (FT-IR) or Raman spectroscopy can be used. An additional advantage of FT-IR is that it is a comparatively inexpensive and fast technique to gather information of the chemical composition, allowing also further sample analysis by different methods.

For this study, core samples of coastal sediments collected offshore Ganghwado island (Yellow Sea, Republic of Korea) and riverbed sediments of the Fugitz River, a tributary of the Thaya River in Lower Austria (Austria), were prepared for MP identification by FT-IR (Bruker Lumos II, nitrogen-cooled MCT detector). No established workflow existed for this technique at the labs of the Department of Geology, University of Vienna so far. Existing methods described in literature lack standardization regarding sampling, removing natural organic matter, sample density separation and measuring mode (transmission, ATR, type of detector). Additionally, in a lot of studies, sediments are artificially spiked with new polymers that have not been altered by natural processes. Therefore, in our study, the main focus shifted towards implementing a best practice approach suitable for natural sediment samples yielding altered MP particles and fibers. These particles might have encountered sorting, (re)deposition, burial, compaction, cementation, leaching, degradation, UV and/or biofilm exposure, depending on the environment and depositional history of the sediment. Another challenge is given by the fact that most polymers contain producer-specific additives, based on the intended use, which can be substituted in the recipe quickly and without any declaration. This might cause problems for the interpretation of FT-IR spectra, particularly for older samples, because limited information exists regarding the alteration and degradation effects of the additives in combination with changes of the main polymer component.

Session: *DEUQUA Session: Anthropogenic impact on the development of landscapes*
Keywords: *microplastics, FT-IR, Anthropocene, Fugitz river, Yellow Sea*