

A clear plastic bottle is shown at the top, with a large, bold yellow letter 'A' superimposed over its neck. The bottle is depicted as shattering, with a dense cloud of small, translucent plastic fragments falling from its base. The background is a solid blue color.

# **A Poison Like No Other**

**How Microplastics  
Corrupted Our Planet  
and Our Bodies**

**Matt Simon**



# Tiny Toxicants

**At least 10,500 different chemicals in plastics, many of which are known to be toxic, including formaldehyde, cadmium, and lead**

**As microplastics fragment, they leach these chemicals out, poisoning anything in the vicinity**



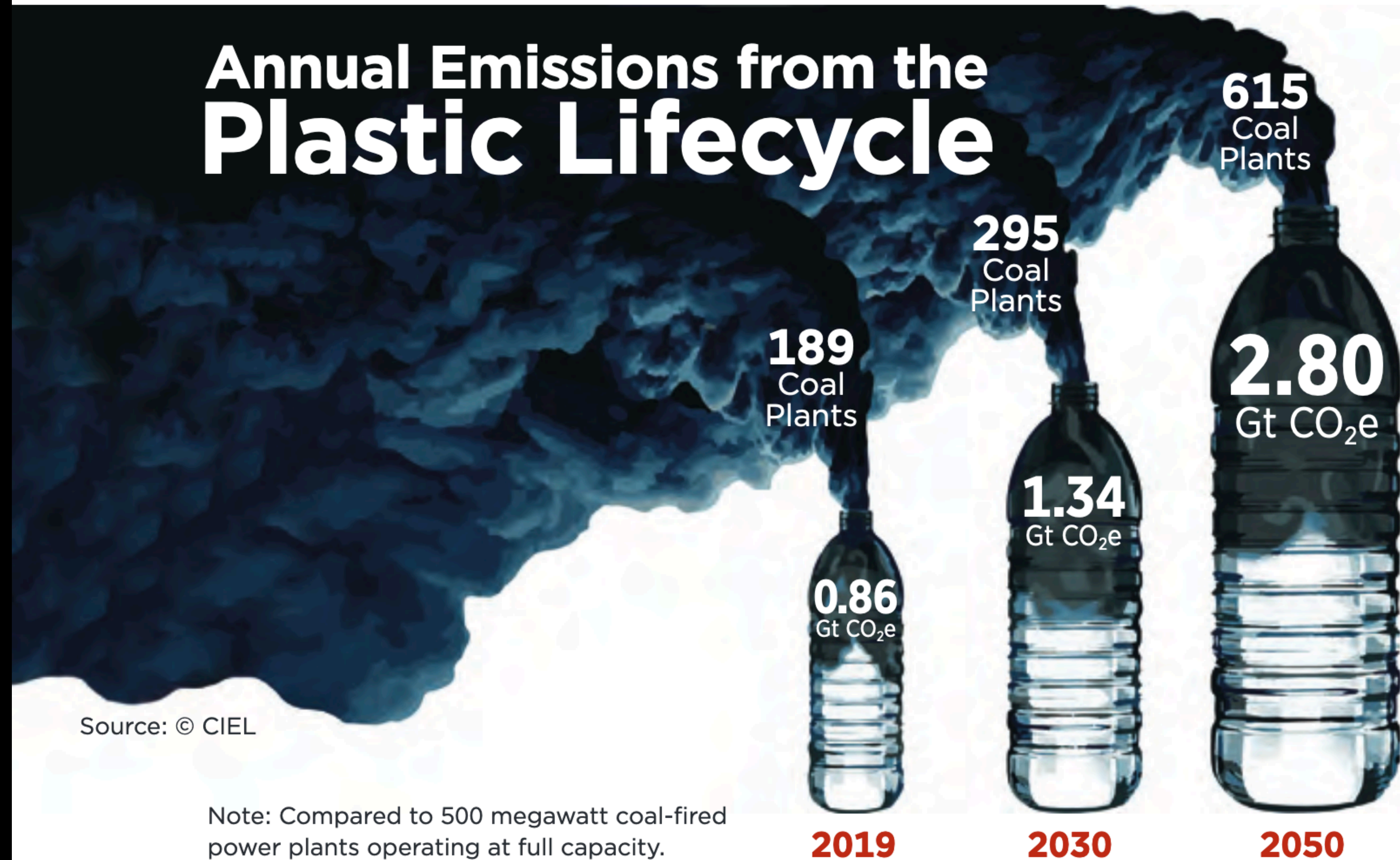
*Reference: Wiesinger, Helene, Zhanyun Wang, and Stefanie Hellweg. 2021. "Deep Dive into Plastic Monomers, Additives, and Processing Aids." *Environmental Science and Technology* 55 (13): 9339–51*



**Plastics *are* fossil fuels**

**If the plastics industry were a country, it'd be a the fifth largest polluter.**

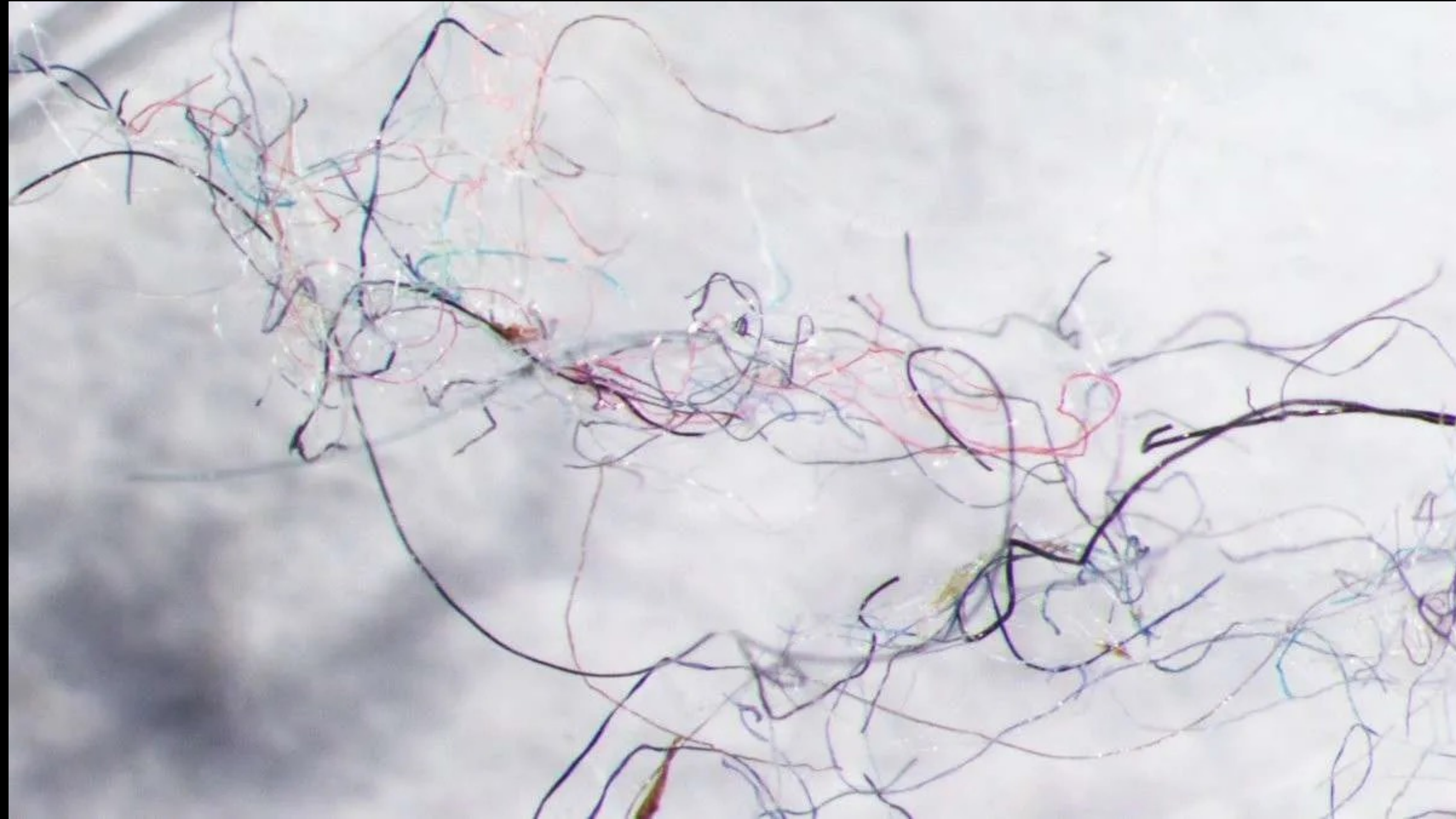
# Annual Emissions from the Plastic Lifecycle



*Reference: Center for International Environmental Law. 2019. "Plastic and Climate: The Hidden Costs of a Plastic Planet."*



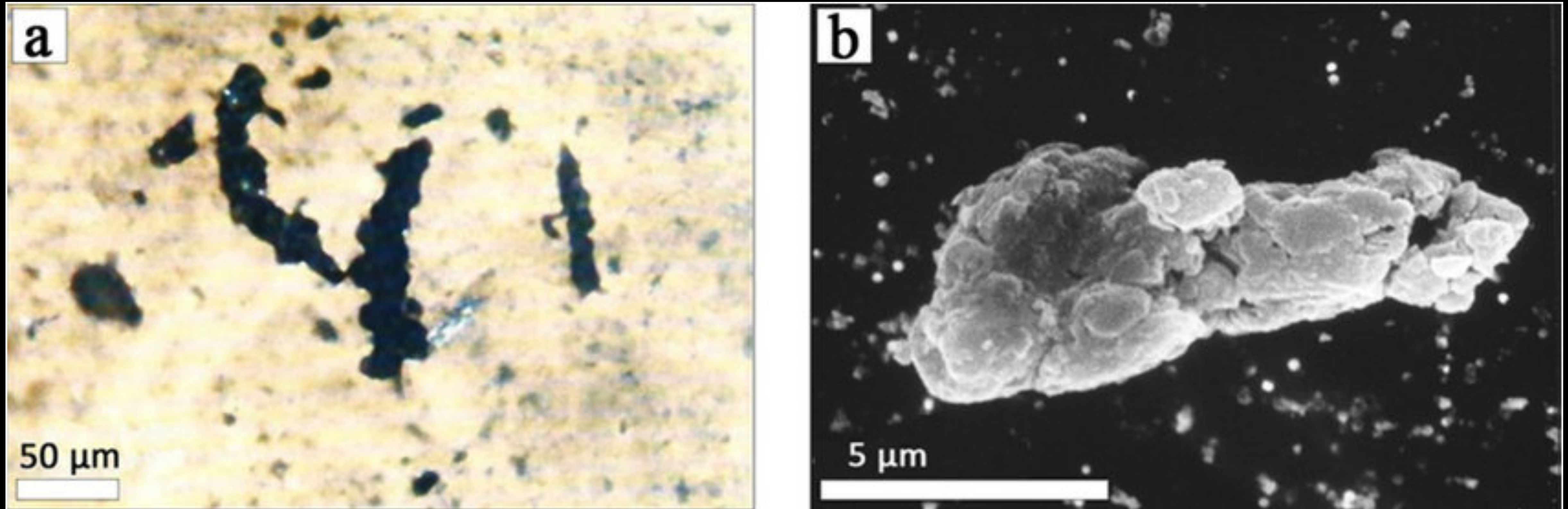
**Since 1950, over 6 billion pounds of microfibers have escaped our clothes and entered water bodies, equivalent to over 7 billion fleece jackets by mass. By 2050, washing machines will be churning out 1.5 billion pounds of plastic a year.**



*Reference: Gavigan, Jenna, Timnit Kefela, Ilan Macadam-Somer, Sangwon Suh, and Roland Geyer. 2020. "Synthetic Microfiber Emissions to Land Rival Those to Waterbodies and Are Growing." PLoS ONE 15 (9): e0237839.*



**One estimate puts global tire microplastic emissions at 13 billion pounds each year, enough material to fill 31 of the biggest container ships, each of which is a quarter mile long.**



*Reference: Kole, Pieter Jan, Ansje J. Löhr, Frank G. A. J. Van Belleghem, and Ad M. J. Ragas. 2017. "Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment." International Journal of Environmental Research and Public Health 14 (10): 1265.*



**Of the 6 trillion cigarettes smoked worldwide each year, 4.5 trillion become litter, contributing 660 million pounds of microfibers to water bodies**



*Reference: Belzagui, Francisco, Valentina Buscio, Carmen Gutiérrez-Bouzán, and Mercedes Vilaseca. 2021. "Cigarette Butts as a Microfiber Source with a Microplastic Level of Concern." Science of the Total Environment 762:144165.*



**500 million pounds  
of nurdles enter the  
oceans each year**



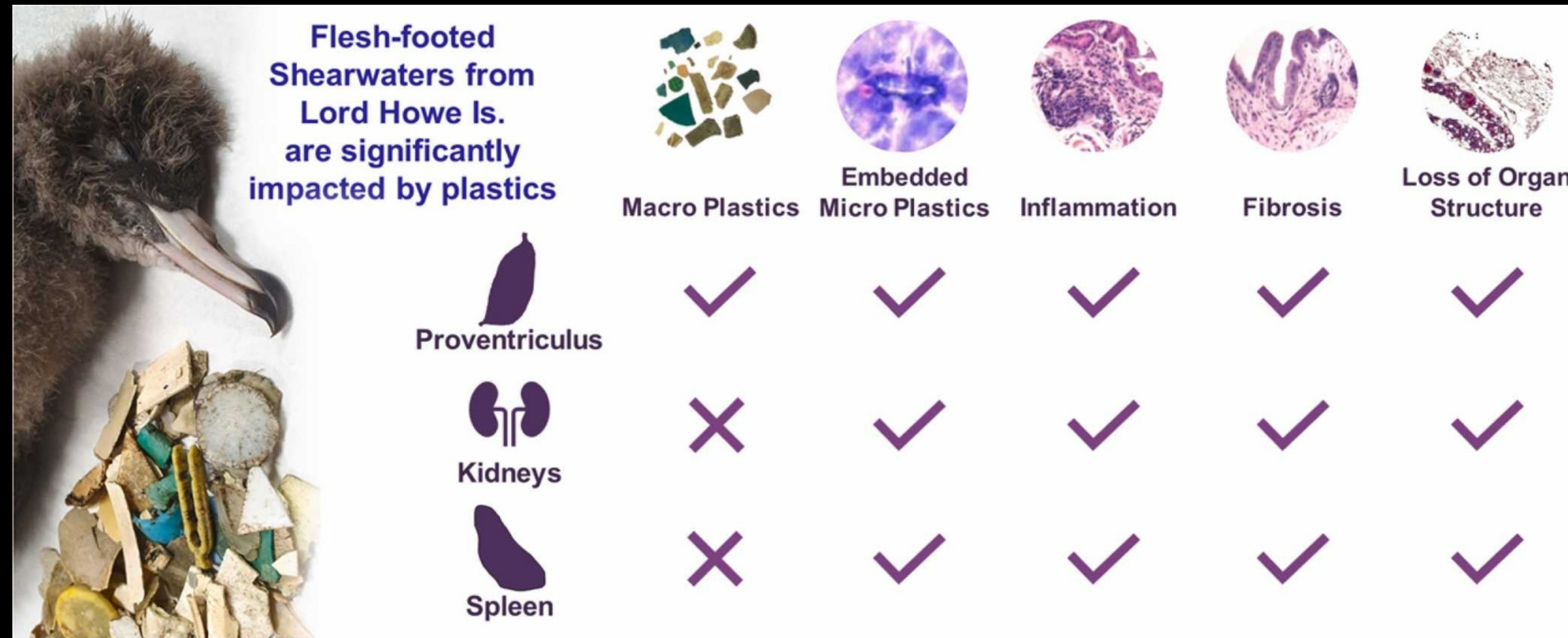
*Reference: The Great Nurdle Hunt. n.d. "The Problem."  
<https://www.nurdlehunt.org.uk/the-problem.html>*



# Microplastics in birds

Study of shearwaters found microplastics embedded in every organ examined.

This causes significant tissue damage, including inflammation, fibrosis, and loss of organ structures in the kidney and spleen, indicating that “microplastics can be mobilised throughout the body causing widespread pathology.”



Ingested macroplastics fragment into microplastics in the gut.

*Reference: Rivers-Auty, J, Bond, A L, Grant, M L, & Lavers, J L. 2022. The one-two punch of plastic exposure: Macro- and micro-plastics induce multi-organ damage in seabirds. Journal of Hazardous Materials.*



**One survey of the North Pacific found an average of 8,300 particles per liter of seawater. Another estimated that up to 46 billion pounds of microplastics swirl in just the top 650 feet of the Atlantic Ocean.**

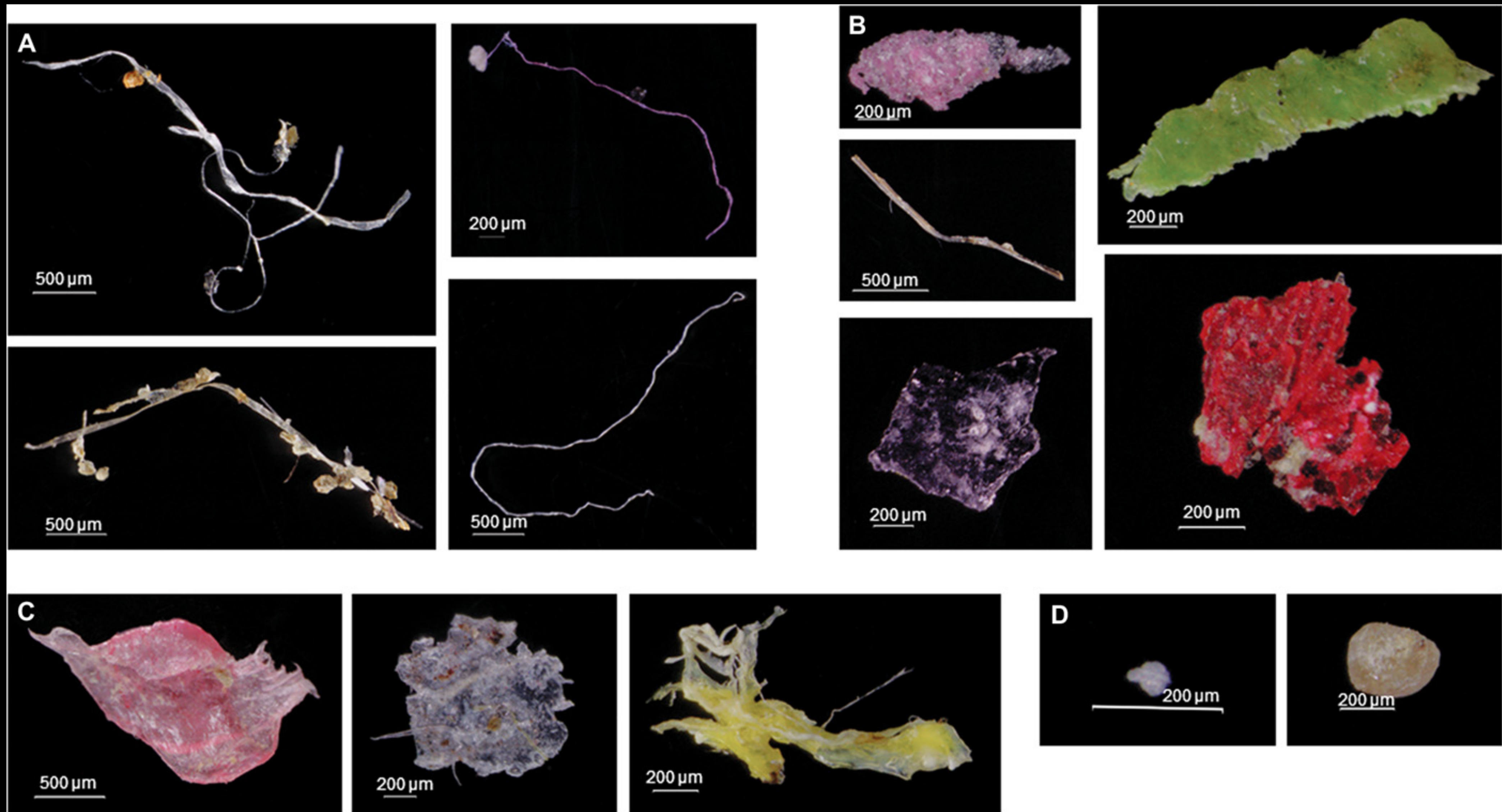


*Reference: Brandon, Jennifer A., Alexandra Freibott, and Linsey M. Sala. 2020. "Patterns of Suspended and Salp-Ingsted Microplastic Debris in the North Pacific Investigated with Epifluorescence Microscopy." Limnology and Oceanography Letters 5 (1).*

*Pabortsava, Katsiaryna, and Richard S. Lampitt. 2020. "High Concentrations of Plastic Hidden Beneath the Surface of the Atlantic Ocean." Nature Communications 11:4073.*



# Microplastics in ocean sediments off California



Reference: Brandon, Jennifer A., William Jones, and Mark D. Ohman. 2019. "Multidecadal Increase in Plastic Particles in Coastal Ocean Sediments." *Science Advances* 5 (9): eaax0587.

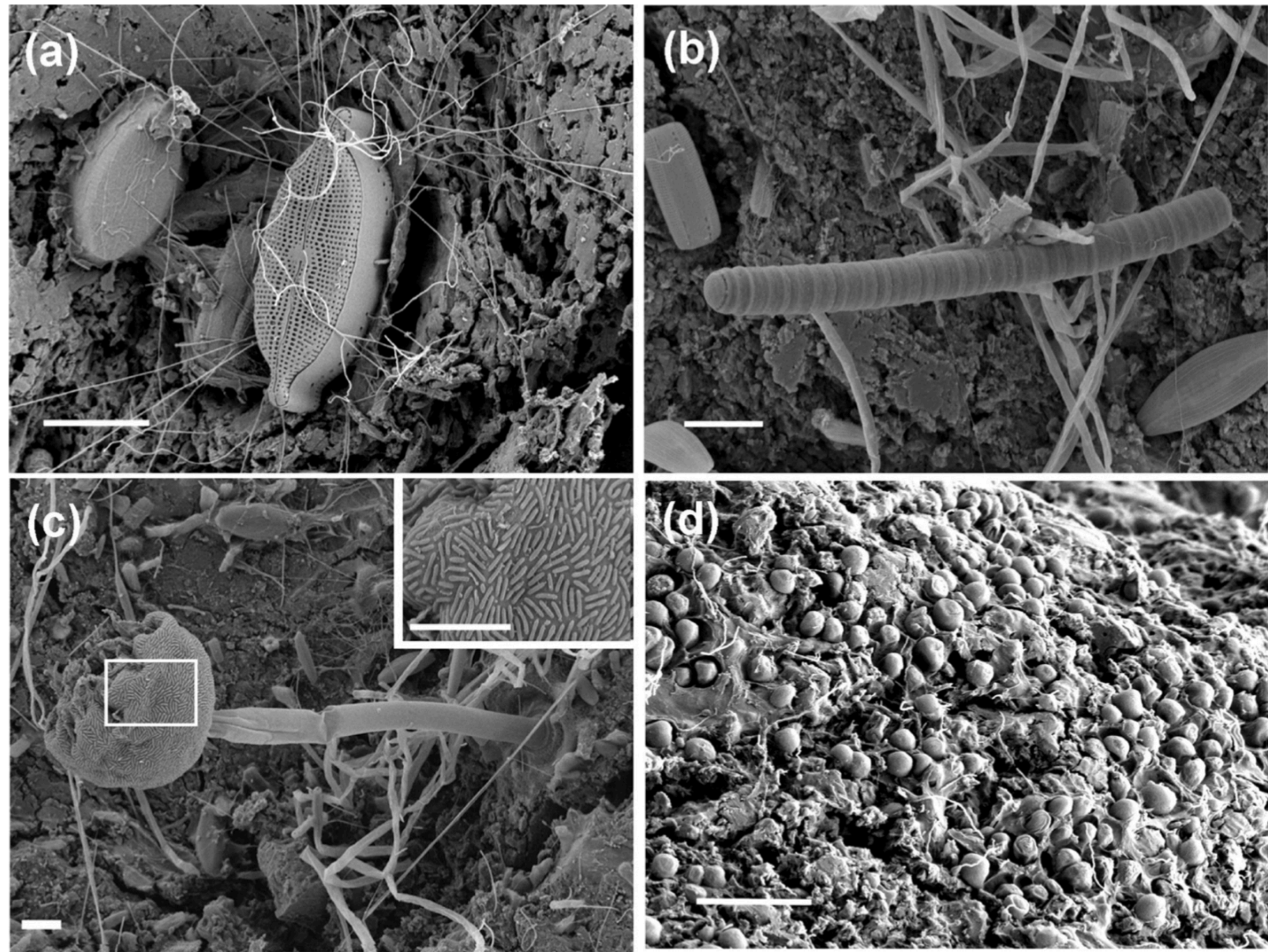


# Life in the plastisphere

An extraordinarily complex  
“plastisphere” of microbes  
on microplastics

This ecosystem transforms  
as a microplastic moves  
between environments

Many human pathogens,  
including antibiotic-  
resistant bacteria, have  
been found in the  
plastisphere



*Reference: Zettler, Erik R., Tracy J. Mincer, and Linda A. Amaral-Zettler. 2013. "Life in the 'Plastisphere': Microbial Communities on Plastic Marine Debris." Environmental Science and Technology 47 (13): 7137–46.*



# Sludge

**Bad news: The particles are sequestered in “sludge,” which is then spread on fields as fertilizer.**

**According to one estimate, in North America nearly 700 million pounds of microplastic are spread on fields each year via sludge, while in Europe it's closer to a billion pounds.**



*Reference: Nizzetto, Luca, Sindre Langaas, and Martyn Futter. 2016. "Pollution: Do Microplastics Spill on to farm soils?" Nature 537 (488).*



# Breathe Deep the Plastic Air

Each year, the  
equivalent of billions of  
plastic bottles falls on  
the US as microplastic.

In the remote Alps, 19  
billion *nanoplastics* are  
deposited per square  
foot of snow every  
week.

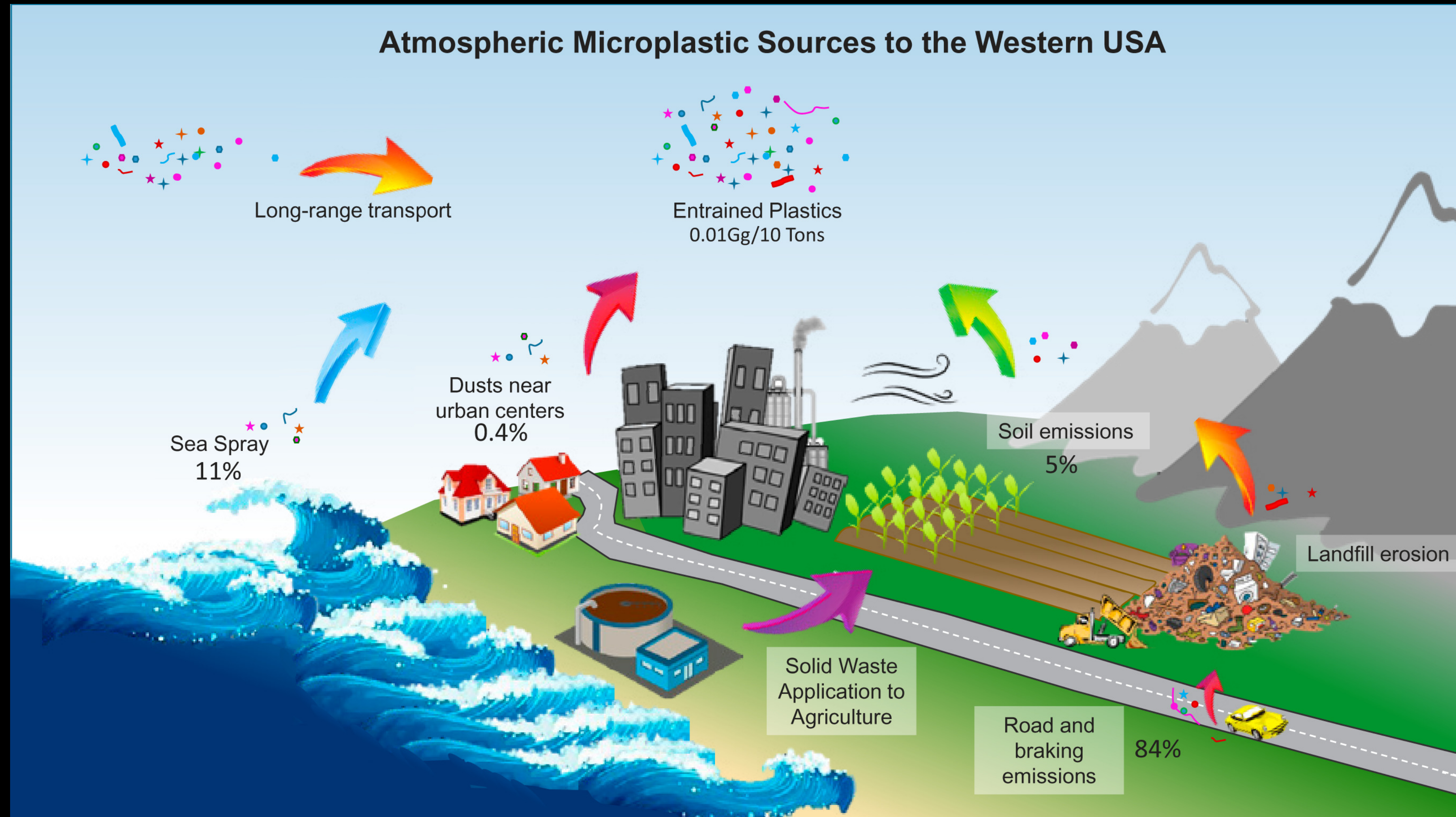


*Reference: Brahney, Janice, Margaret Hallerud, Eric Heim, Maura Hahnenberger, and Suja Sukumaran. 2020. "Plastic Rain in Protected Areas of the United States." Science 368:1257–60.*

*Materić, Dušan, Elke Ludewig, Dominik Brunner, Thomas Röckmann, and Rupert Holzinger. 2021. "Nanoplastics Transport to the Remote, High-Altitude Alps." Environmental Pollution 288:117697.*



# The Microplastic Cycle



Reference: Brahney, Janice, Natalie Mahowald, Marje Prank, Gavin Cornwell, Zbigniew Klimont, Hitoshi Matsui, and Kimberly Ann Prather. 2021. "Constraining the Atmospheric Limb of the Plastic Cycle." *Proceedings of the National Academy of Sciences* 118 (16): e2020719118.



# Air is most polluted *indoors*

Everything plastic around us—clothing, couches, carpet, food packaging—spews particles.

We might inhale 7,000 microplastics a day, according to one estimate. And that's not including *nanoplastics*.

Hundreds of thousands of particles are deposited on your living room floor each day.



*Reference: Soltani, Neda Sharifi, Mark Patrick Taylor, and Scott Paton Wilson. 2021. "Quantification and Exposure Assessment of Microplastics in Australian Indoor House Dust." Environmental Pollution 283:117064.*



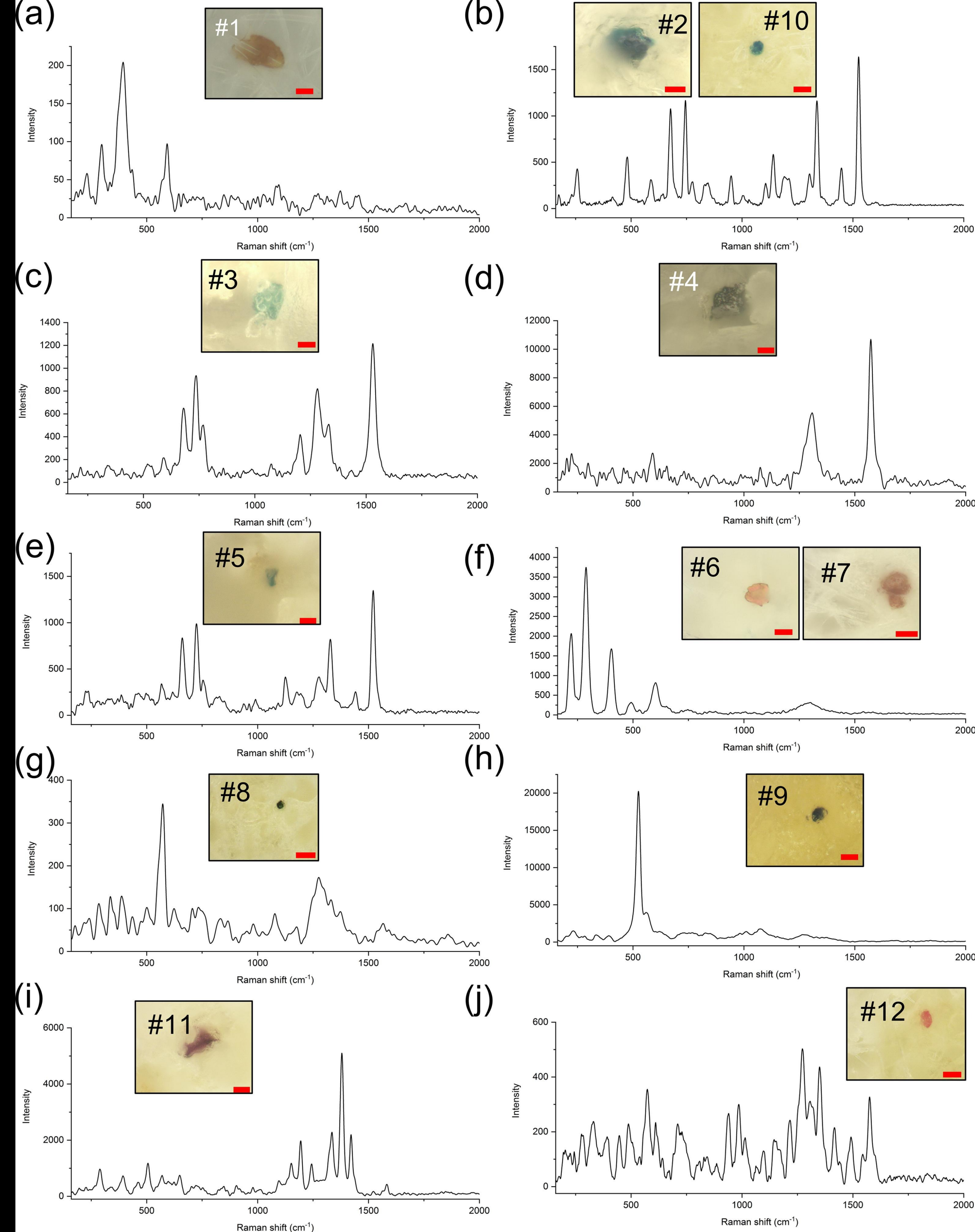
# Microplastics in the human body

Microplastics have been found in the lungs, gut, liver, placenta (images at right) —as well as blood, feces, and breast milk.

EDCs in particular are seriously toxic, even in low doses.

Phthalate (a plasticizer chemical) exposure alone may lead to 100,000 premature deaths in the US each year, according to one *conservative* estimate

Reference: Trasande, Leonardo, Buyun Liu, and Wei Bao. 2021. "Phthalates and Attributable Mortality: A Population-Based Longitudinal Cohort Study and Cost Analysis." *Environmental Pollution* 118021.





# Fetuses, infants, and toddlers at particular risk

**Their developing bodies are extremely sensitive to EDCs.**

**Infants may be drinking millions of microplastics and nanoplastics a day if their formula is prepared in a plastic bottle.**

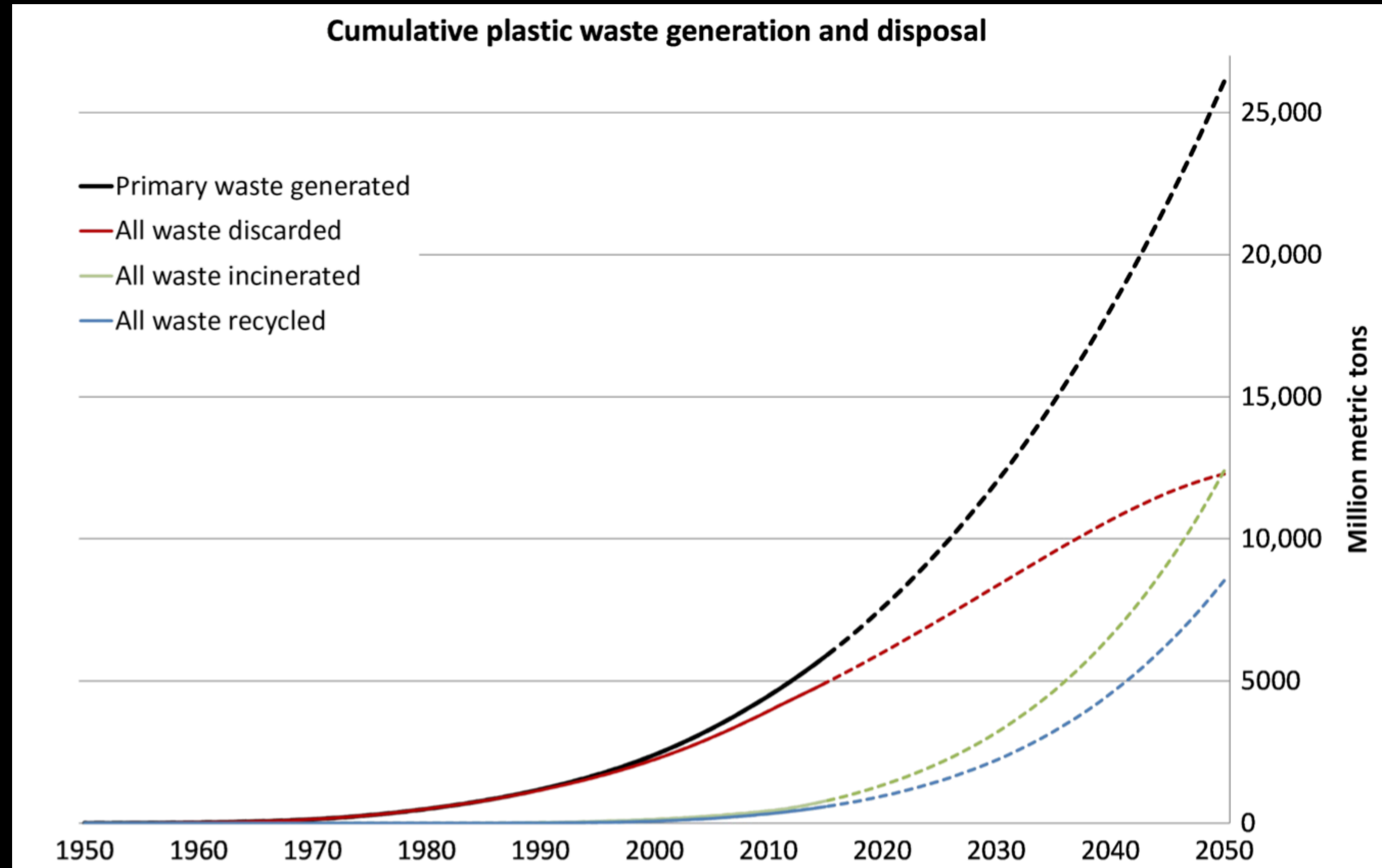
**Toddlers crawl around on the floor, where microplastics settle.**



*Reference: Li, Dunzhu, Yunhong Shi, Luming Yang, Liwen Xiao, Daniel K. Kehoe, Yurii K. Gun'ko, John J. Boland, and Jing Jing Wang. 2020. "Microplastic Release from the Degradation of Polypropylene Feeding Bottles during Infant Formula Preparation." Nature Food 1:746–754*



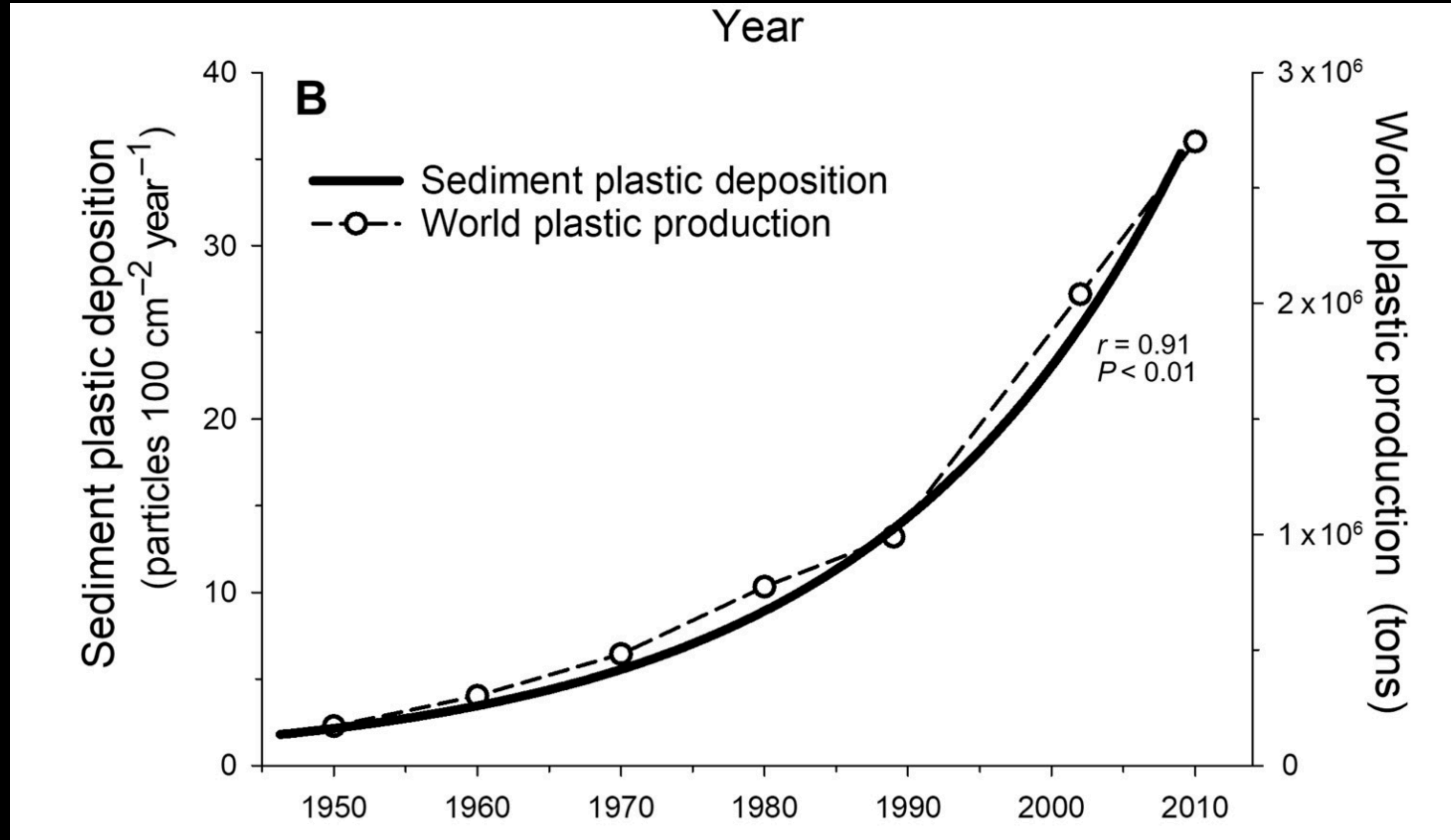
# Plastic waste from 1950 to 2050



Reference: Geyer, Roland, Jenna R. Jambeck, and Kara Lavender Law. 2017. "Production, Use, and Fate of All Plastics Ever Made." *Science Advances* 3 (7): e1700782.



# Plastic production / sedimentary plastics



Reference: Brandon, Jennifer A., William Jones, and Mark D. Ohman. 2019. "Multidecadal Increase in Plastic Particles in Coastal Ocean Sediments." *Science Advances* 5 (9): eaax0587.



# Study of freshwater fish specimens, dating back to 1900

Reference: Hou, Loren, Caleb D. McMahan, Rae E. McNeish, Keenan Munno, Chelsea M. Rochman, and Timothy J. Hoellein. 2021. "A Fish Tale: A Century of Museum Specimens Reveal Increasing Microplastic Concentrations in Freshwater Fish." *Ecological Applications* 31 (5)

