

Mercury Science Bulletin - Recent Findings from Scientific Research

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1. Introduction

This poster summarizes recent advances in mercury science and policy from the academic literature, related to outstanding issues in the developing mercury treaty.

MIT's Joint Program on the Science & Policy of Global Change aims to improve knowledge of interactions among human and natural Earth systems through interdisciplinary research. Our goal here is to communicate state-of-the-science information on mercury emissions in a way that is policy relevant and to facilitate the strengthening of the science-policy interface.

1. Mercury continues to cycle through the earth system long after it is emitted.
2. Options for reducing mercury emissions have many additional social benefits.
3. Mercury releases to land and water are significant and trans-boundary in nature.



For a copy of this poster and more mercury science and policy updates, take a picture of this QR code with your phone.

3. Reducing Coal Emissions has Multiple Benefits

There are multiple approaches for reducing mercury emissions that are cost-effective, and have many additional social and economic benefits.

- Social benefits to some mercury reduction methods include savings in energy demand, fuel costs, carbon emissions, and other harmful air pollutants (NO_x, SO₂). **These co-benefits of mercury reductions have not been included in most studies estimating the benefits of controls** (4, 5, 6).
- Many strategies exist to reduce mercury air emissions from coal. These include: reducing coal use, pre-treating coal, and post-combustion technologies.
- Ingestion and inhalation of methyl mercury cost society globally, based only on IQ losses, an estimated **US\$6.6 billion annually** (4).

2. Historic & Future Mercury Trends depend on Human Actions and Policy Decisions

Since 2000 BCE, 350 Gg of mercury have been re-leased by humans. Only 50 Gg have returned to the Earth's crust. **Thus mercury is increasing in our atmosphere, land surface, and ocean because of human actions** (1, 2).

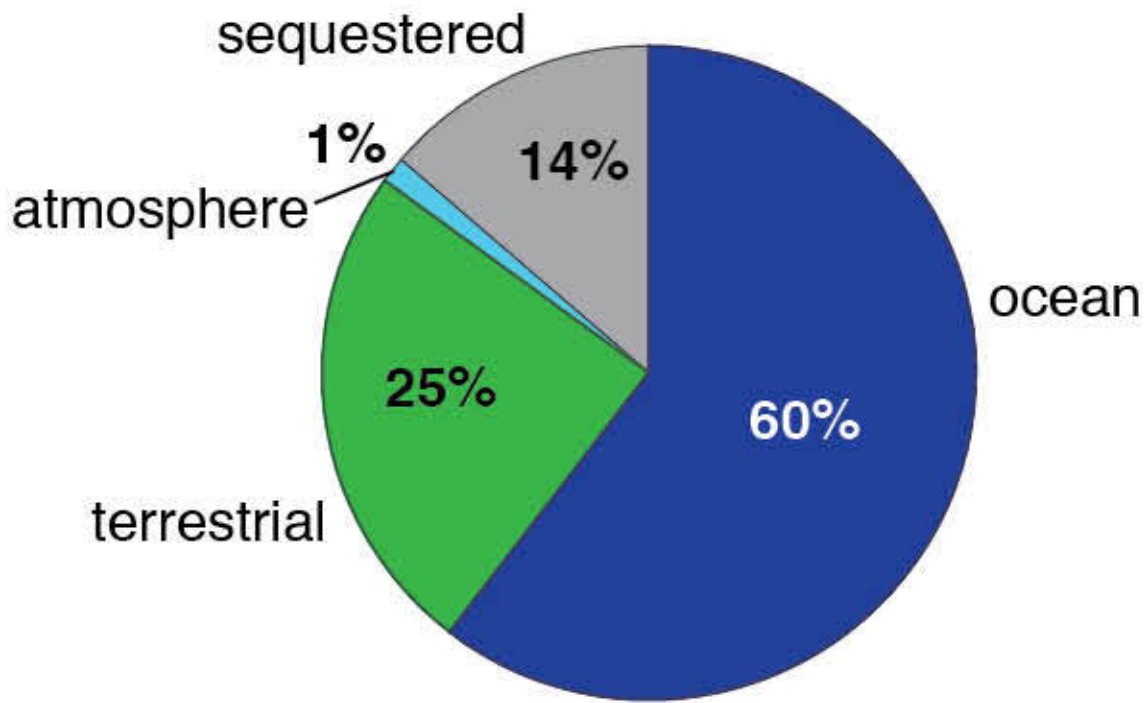


Figure 1. Where is human mercury now? Fate of all-time anthropogenic emissions

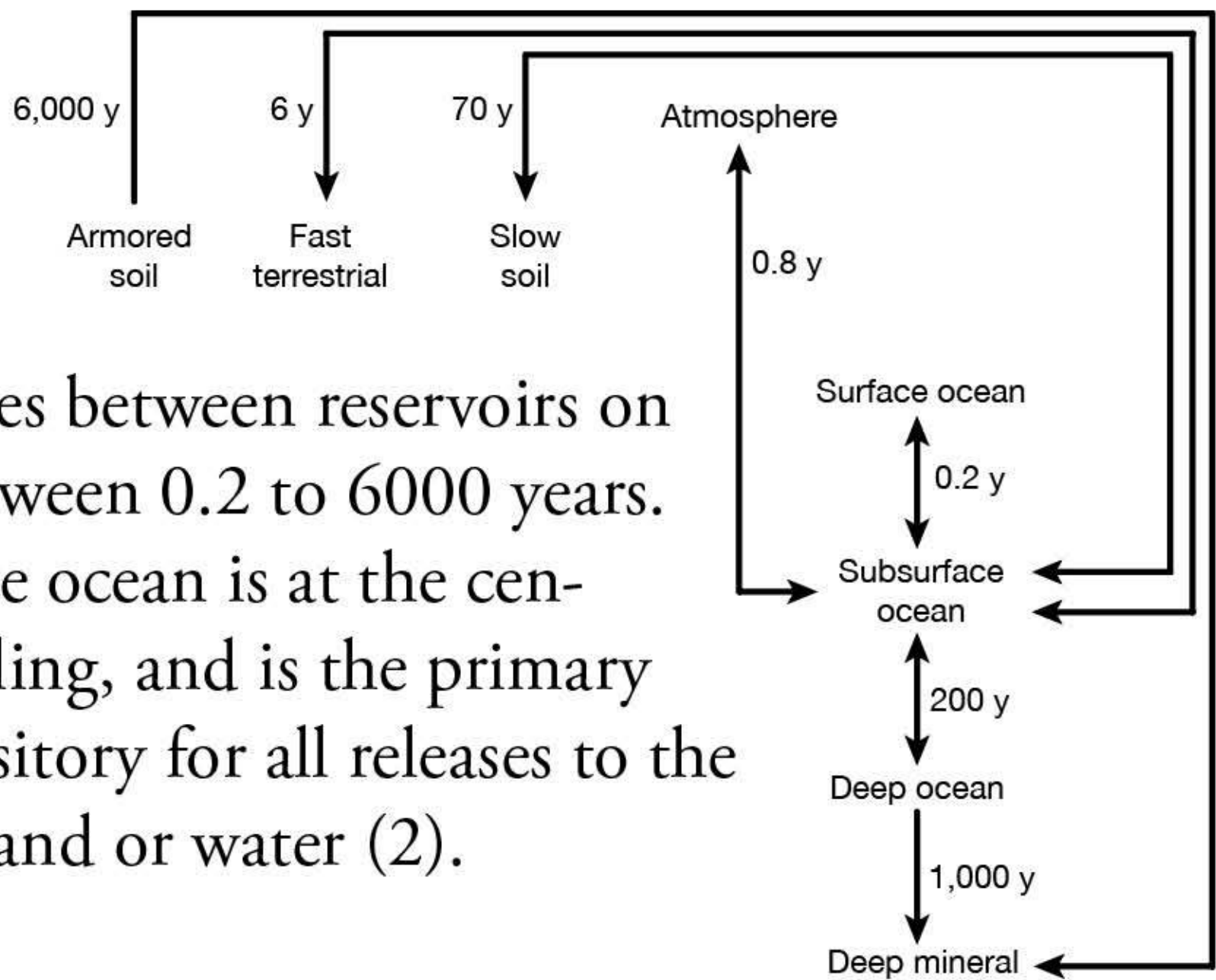


Figure 2. Timescales of mercury cycling range from months to millennia.

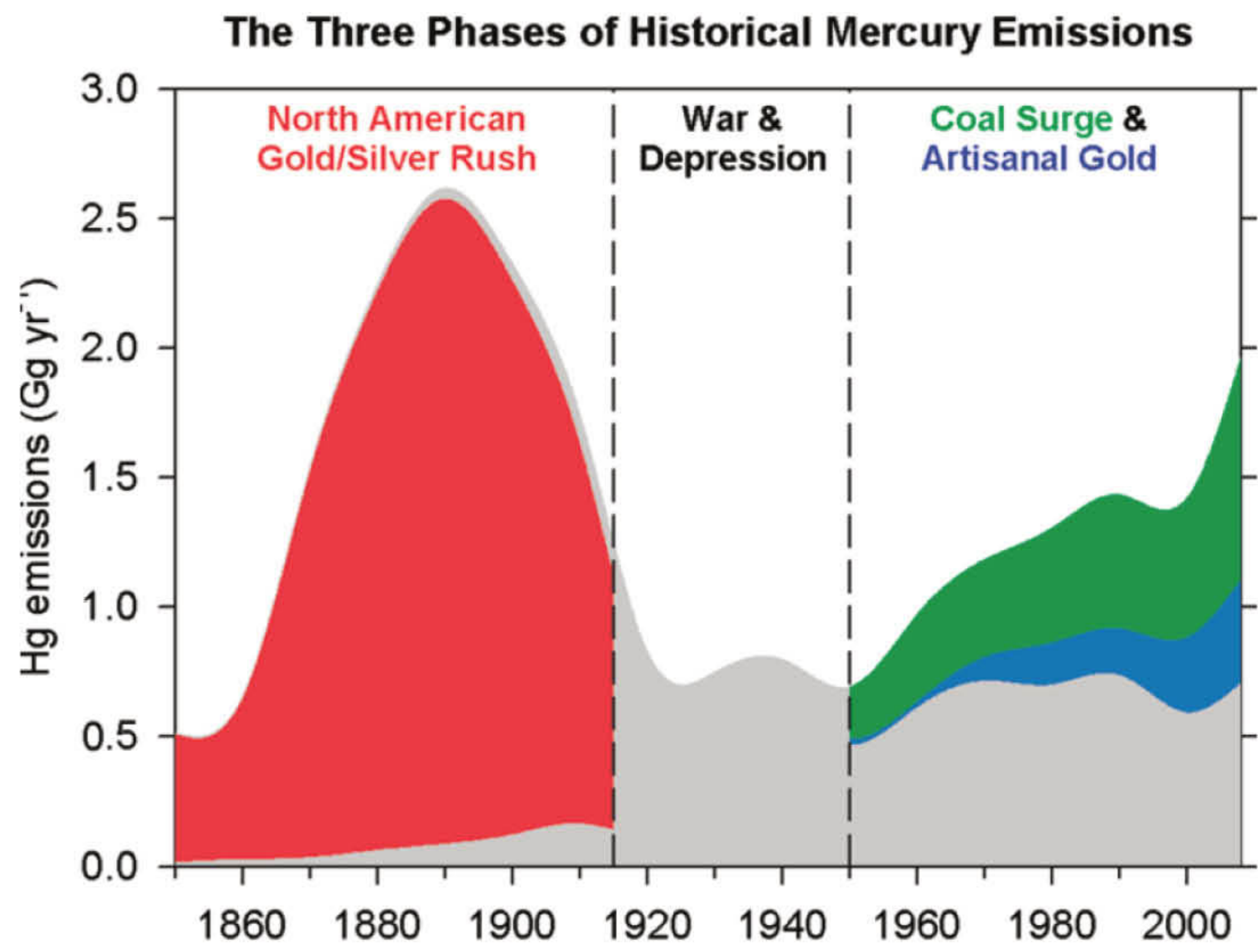
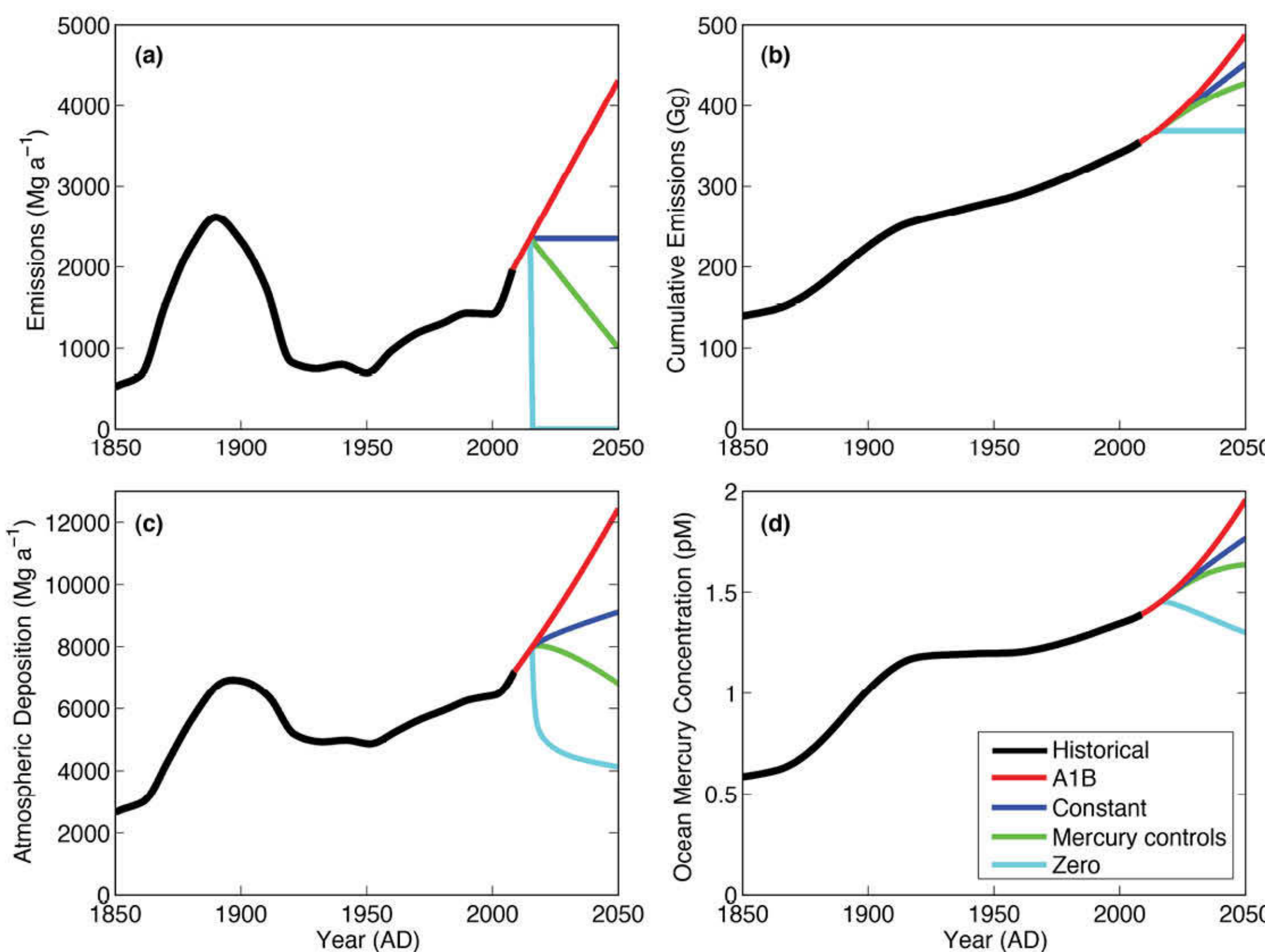


Figure 3. Gold and silver mining during the 19th Century contributed to high mercury emissions, which fell during the two world wars and the Great Depression. Over the past 60 years, mercury emissions have increased primarily due to coal combustion and artisanal and small-scale gold mining (ASGM). **Mercury emissions are still increasing globally** (3).

Mercury's long residence time means that even if future emissions are held constant, atmospheric deposition and ocean mercury concentration will continue to increase. **Current mercury emissions commit us to mercury concentrations far in the future.**

Figure 4. This figure shows four different theoretical emissions trajectories and their consequences (1, 2).



4. Releases to Land & Water have Impacts

- Releases to land and water contribute significant mercury burdens to local watershed hotspots and impact global trans-boundary reservoirs, such as the oceans.
- **Mercury releases to land and water form a non-negligible component of methylmercury in the open ocean.** Addressing releases to land and water would be necessary to inventory, evaluate, and control these releases over time and to understand the total global mercury budget.
- **Commercial and industrial products and processes release mercury to land and water through their use and eventual waste streams.** Continued use of mercury in products or processes would threaten local and global mercury reservoirs through these downstream releases.

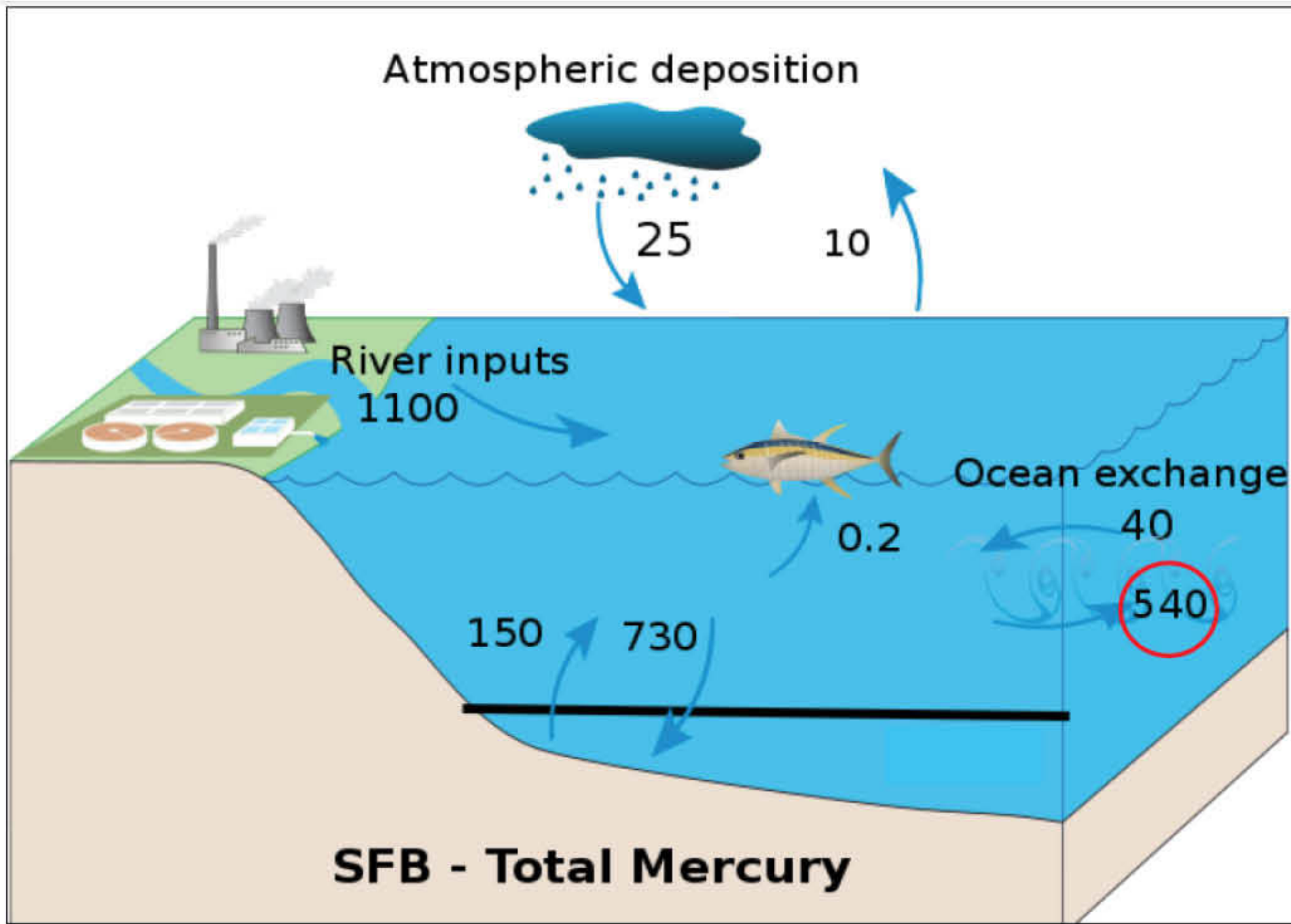


Figure 5. Mercury releases to land and water can end up in rivers, and ultimately offshore. For example, it is estimated that 50% of riverine mercury inputs to the San Francisco Bay estuary eventually end up in the coastal ocean (7). Units are in kg/year.