

A Synthesis of Mercury Research in the Southern Hemisphere



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- Antarctica + Tropics

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GLOBAL MERCURY IMPACT SYNTHESIS: PROCESSES IN THE SOUTHERN HEMISPHERE

A synthesis of mercury research in the Southern Hemisphere, part 1: Natural processes


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GLOBAL MERCURY IMPACT SYNTHESIS: PROCESSES IN THE SOUTHERN HEMISPHERE

A synthesis of mercury research in the Southern Hemisphere, part 2: Anthropogenic perturbations

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Diversity was the Key to Writing this Paper

- Mid-career and senior researchers.
- Gender balance.
- Authors from a wide range of countries and culture (Australia, Argentina, Brazil, South Africa, Venezuela).
- At least five different languages.

Particularities in the SH mercury cycle: unique ecosystem, economy and culture

ASGM



Deforestation



Colonisation



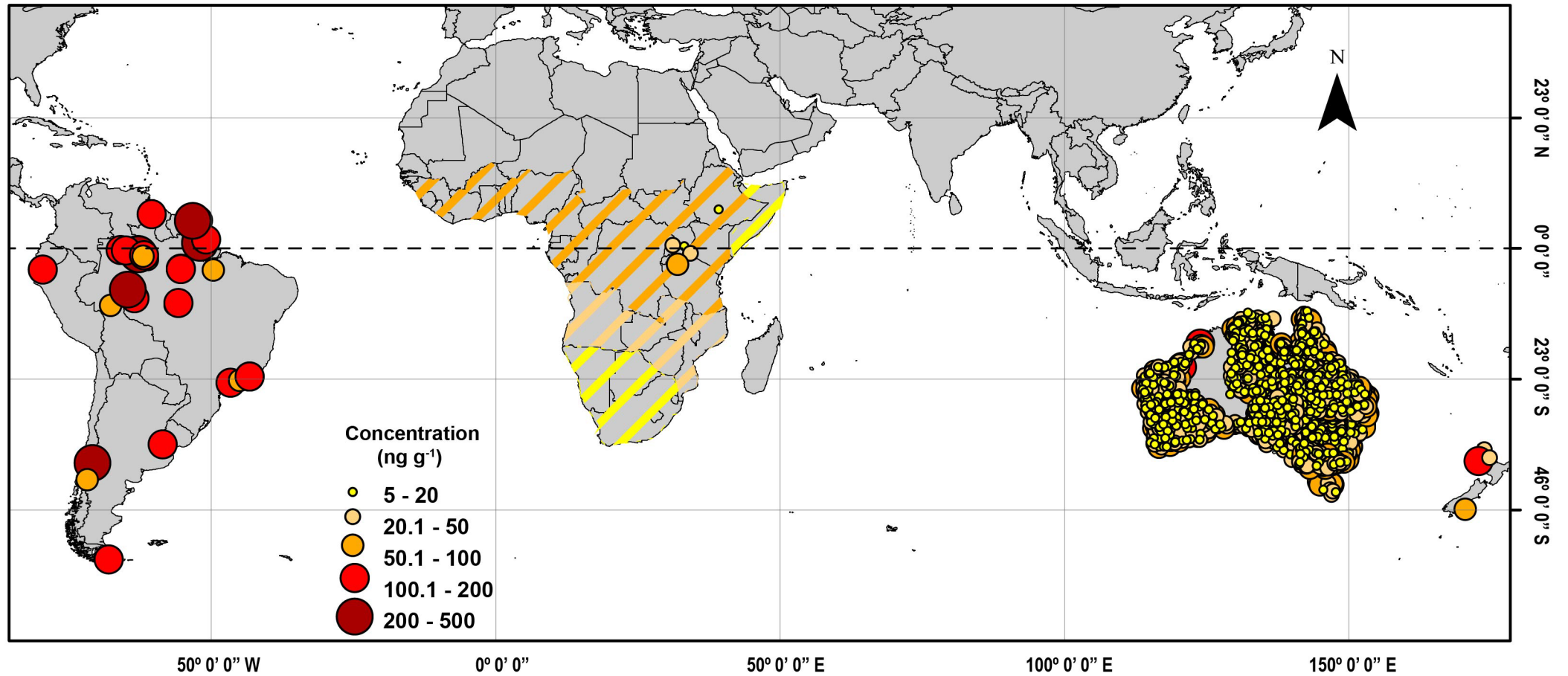
Slash-and-burn agriculture



Ecosystems



Background Hg in the SH: diverse environment



Mercury-Rich Soils in Tropical Forests



Credit: Anne Helene Fostier

[Hg] in Amazon soils: > 100 ng/g.
About **3 X greater** than temperate forests.

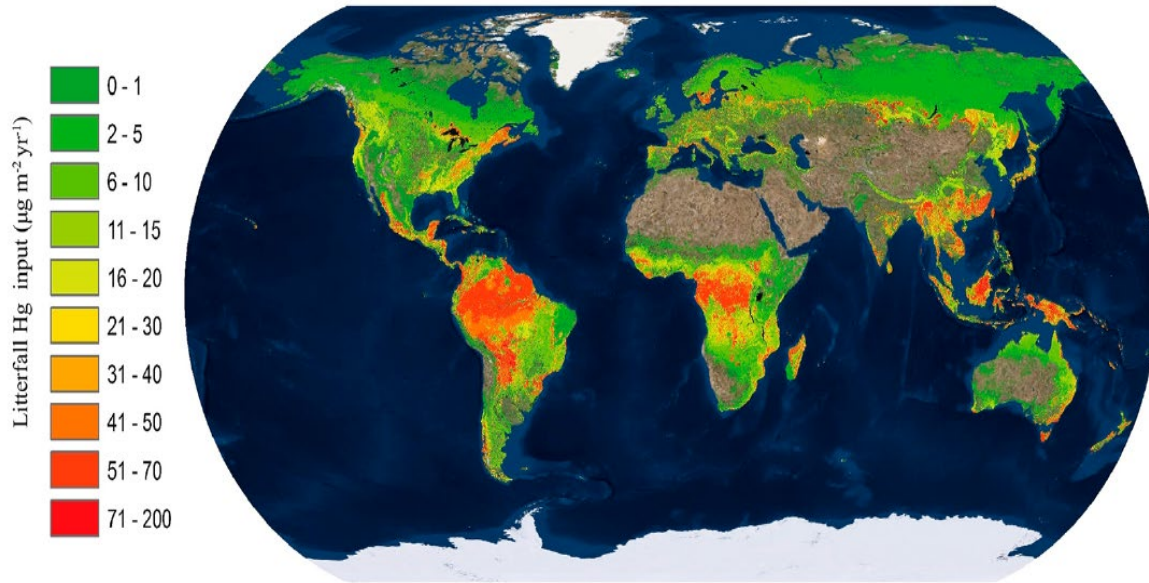
Hg more associated to the mineral soil fraction than to organic fraction.

B horizons: mercury "sponge" over a geological time scale.

Fostier et al. (2015). Environmental Pollution, 206:605-610.
Fostier et al. (2002). Science of the Total Environment, 260:201-212.

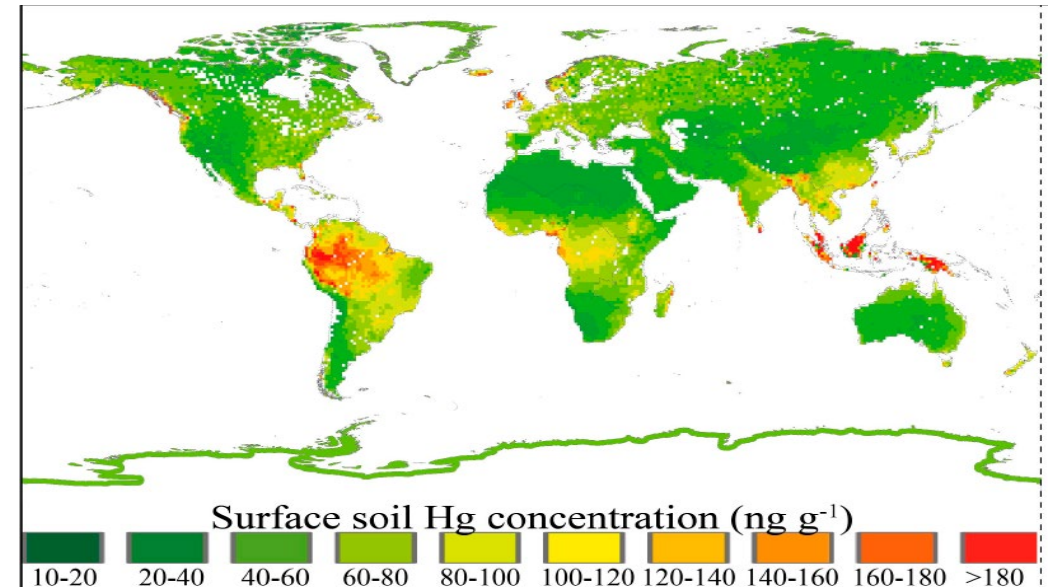
Yuan et al. (2019) Environ. Sci. Technol. 53: 651-660.

Mercury Deposition Through Litterfall



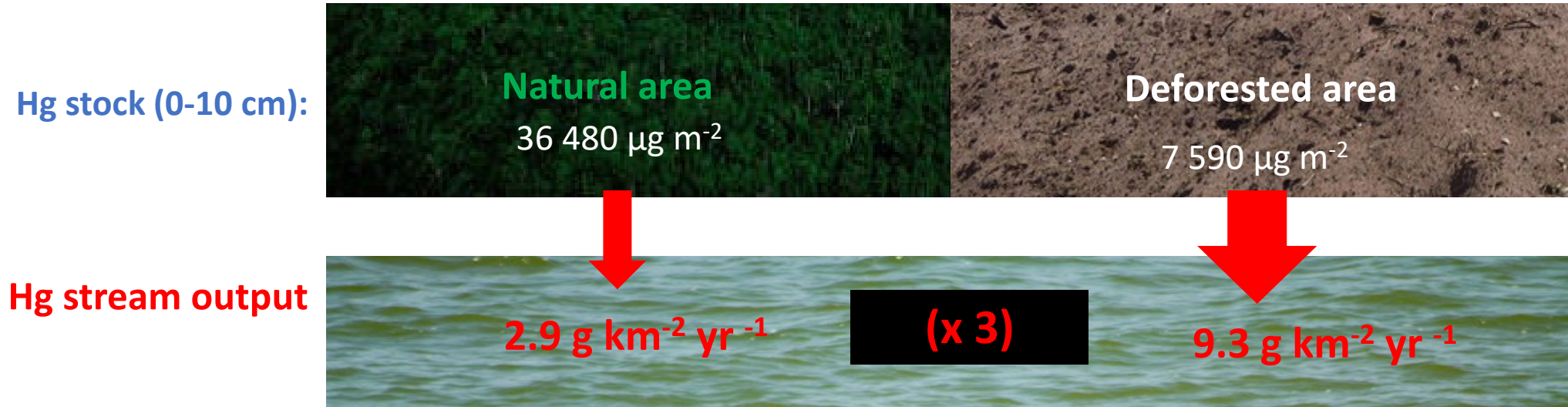
Wang, X. et al. (2016), *Environ. Sci. Technol.*, 50, 8548-8557

Fostier et al. (2015), *Environ. Pollut.*, 206:605-610.



Amazon rainforest: 268 ± 77 ton/yr
23% of the global Hg deposition

Deforestation



Fostier et al. (2000). Sci. Tot. Environ., 260: 201-211

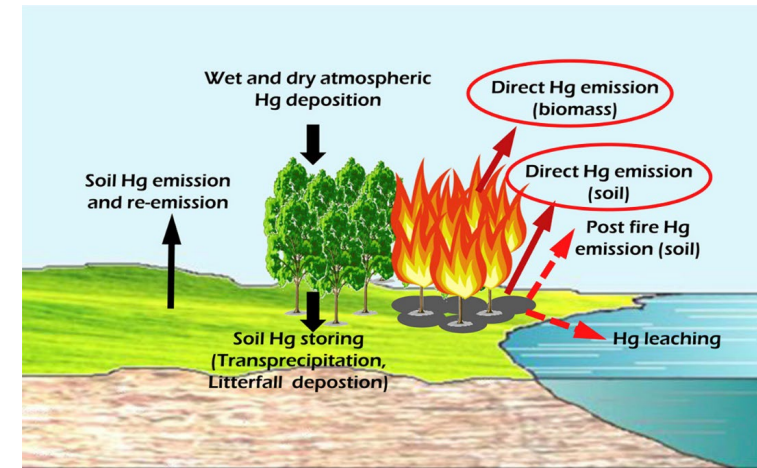
- Intensive leaching and/or erosion processes = greater transport of Hg to aquatic systems.
- Effect of land use on MeHg concentrations in aquatic bodies (?)

SLASH-AND-BURN AGRICULTURE

- Releases Hg back to cycling during erosion and forest fires.
- Most Hg is emitted to the atmosphere.
- Burning results in a great amount of black carbon (reactive, reabsorb Hg from atmosphere).

Wasserman et al. (2003). *AMBIO: A J. of the Human Environment*, 32: 336-342.

Melendez-Perez et al. (2014), *Atmos. Environ.*, 96: 415-422.



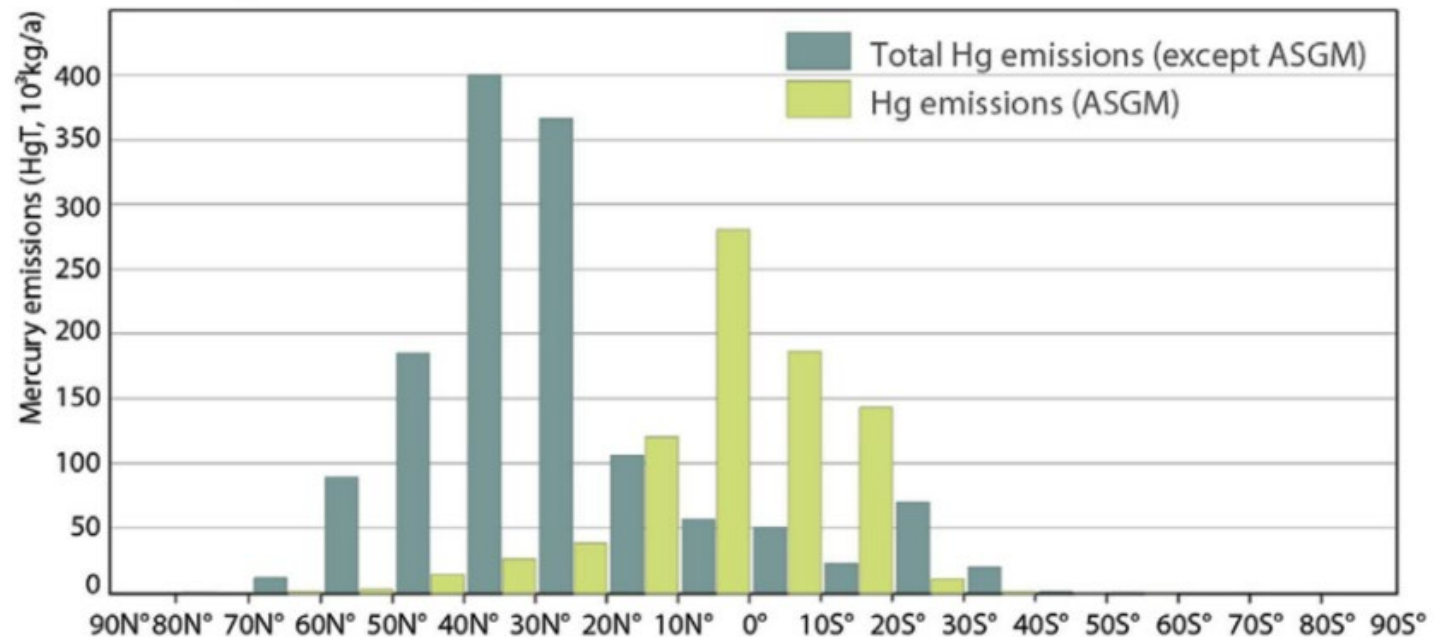
Credit: www.blumberg.com

Australasia, Africa ?

ASGM

- 70% of Hg use in ASGM is within the SH+T.
- Central and South America (~55%).
- Southeast Asia and Africa (15-30% each).
- Most Hg use in ASGM: Peru (327 t yr⁻¹) and Indonesia (427 t yr⁻¹).

Mercury emissions per 10° latitude band

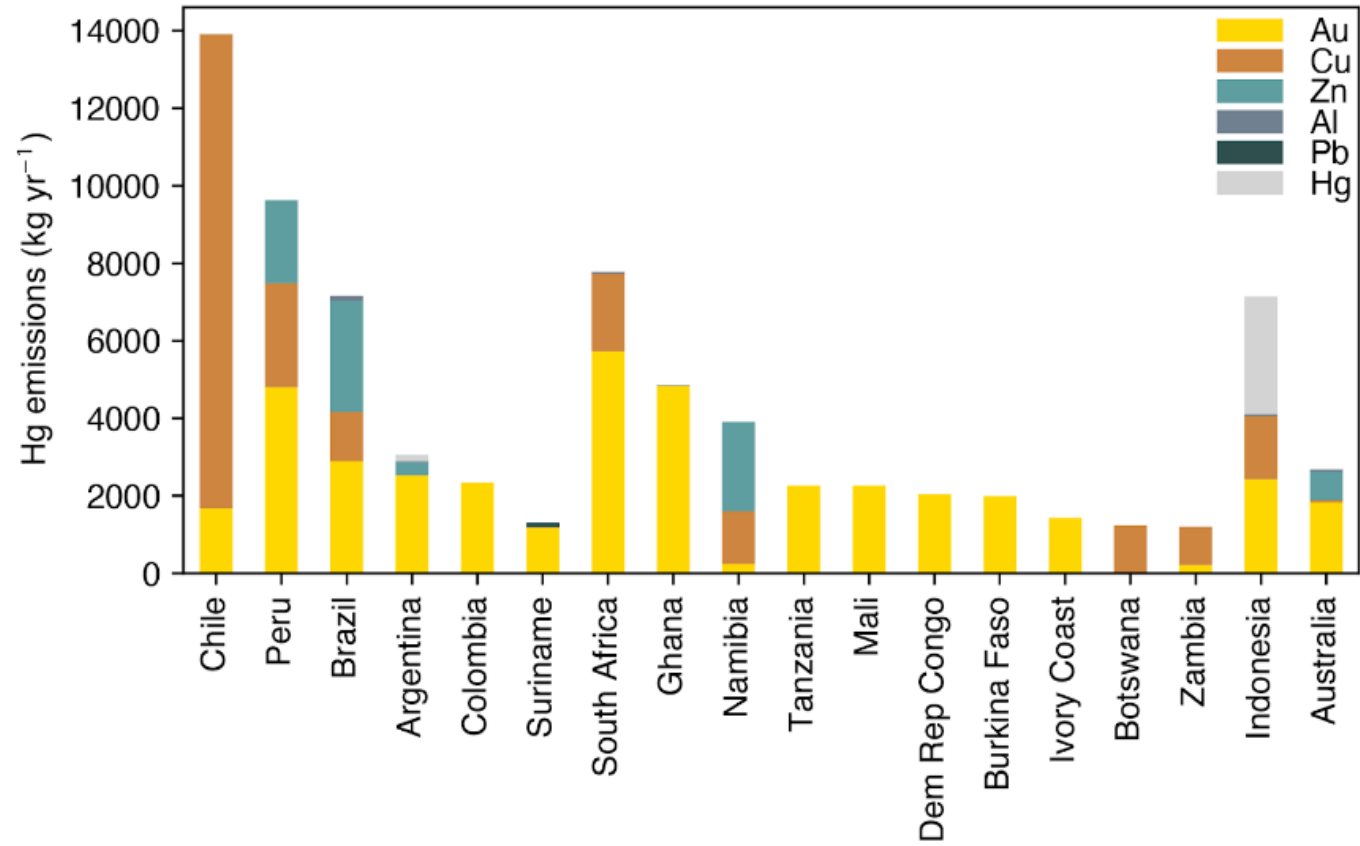


Coal-fired power stations

Major coal consumer countries: South Africa, Australia and Indonesia

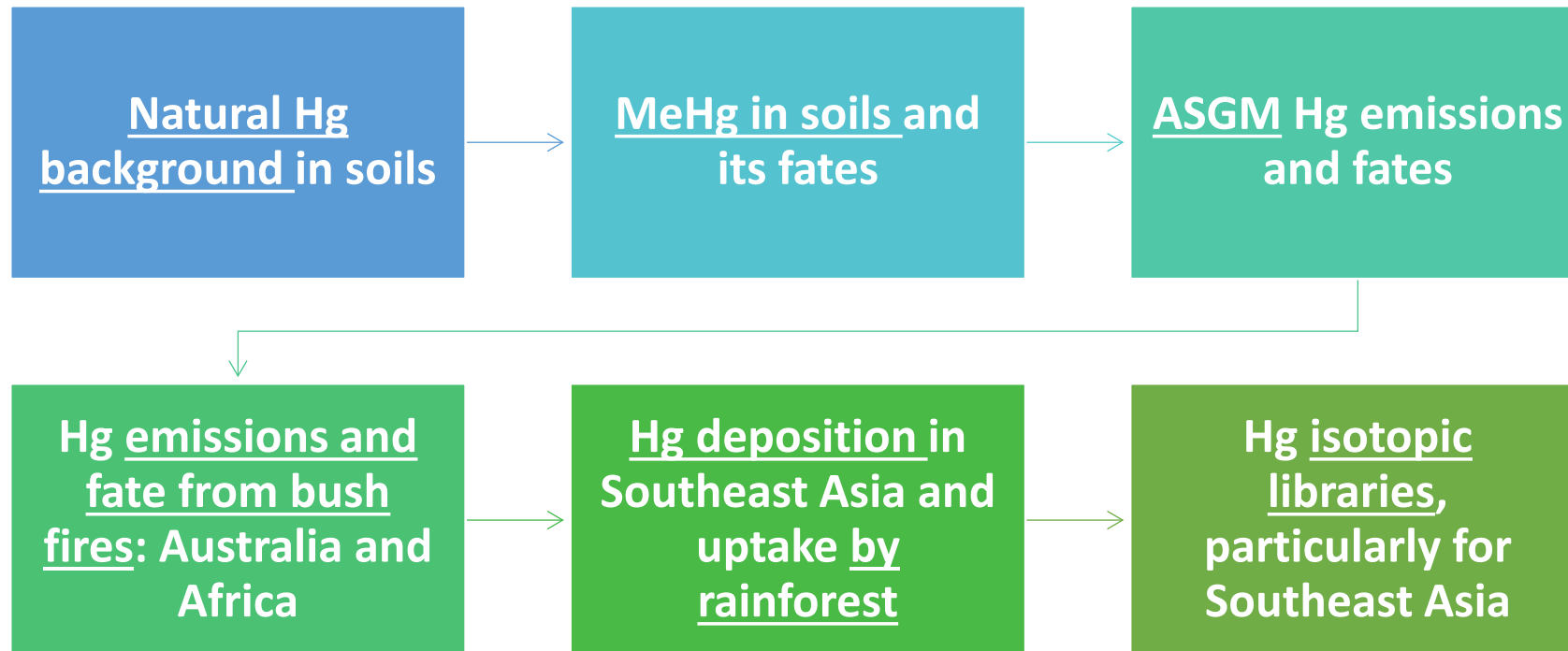
Location	Coal Type	Mean +/- standard deviation (mg kg ⁻¹)	Range (mg kg ⁻¹)	Reference
South Africa	Bituminous	0.15 +/- 0.05	0.010-0.49	Mathebula et al. (2020)
South Africa	Bituminous	0.27 +/- 0.11	0.12-0.70	Garnham & Langerman (2016)
South Africa	Bituminous	0.20 +/- 0.03	0.14-0.30	Lusilao-Makiese et al. (2012)
South Africa	unknown	0.16 +/- 0.17	0.023-0.83	Tewalt et al., 2010
Australia	Bituminous	0.04	0.01-0.13	Dale (2003); Riley et al. (2005); Nelson (2007)
Australia	Brown	0.08 (dry); 0.032 (moisture corrected)	not available	Brockway et al. (1991); Nelson (2007)
Australia	Bituminous	0.065 +/- 0.10	0.011-0.31	Tewalt et al., 2010
Australia	Bituminous	0.043 +/- 0.003	0.040-0.047	Schneider et al., 2021
Australia	Lignite	0.071	one sample	Schneider et al., 2021
Indonesia	unknown	0.056	0.011-0.23	UNEP Indonesia report 2017
Indonesia	unknown	0.10 +/- 0.062	0.022-0.19	Tewalt et al., 2010

- Argentina and Chile: ASGM does not occur, so non-ferrous metal production is the dominant source overall.
- Largest non-ASGM Hg emission source for South American countries



Significant Gaps

Consistent, ongoing measurements for trend analysis



Thanks!

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