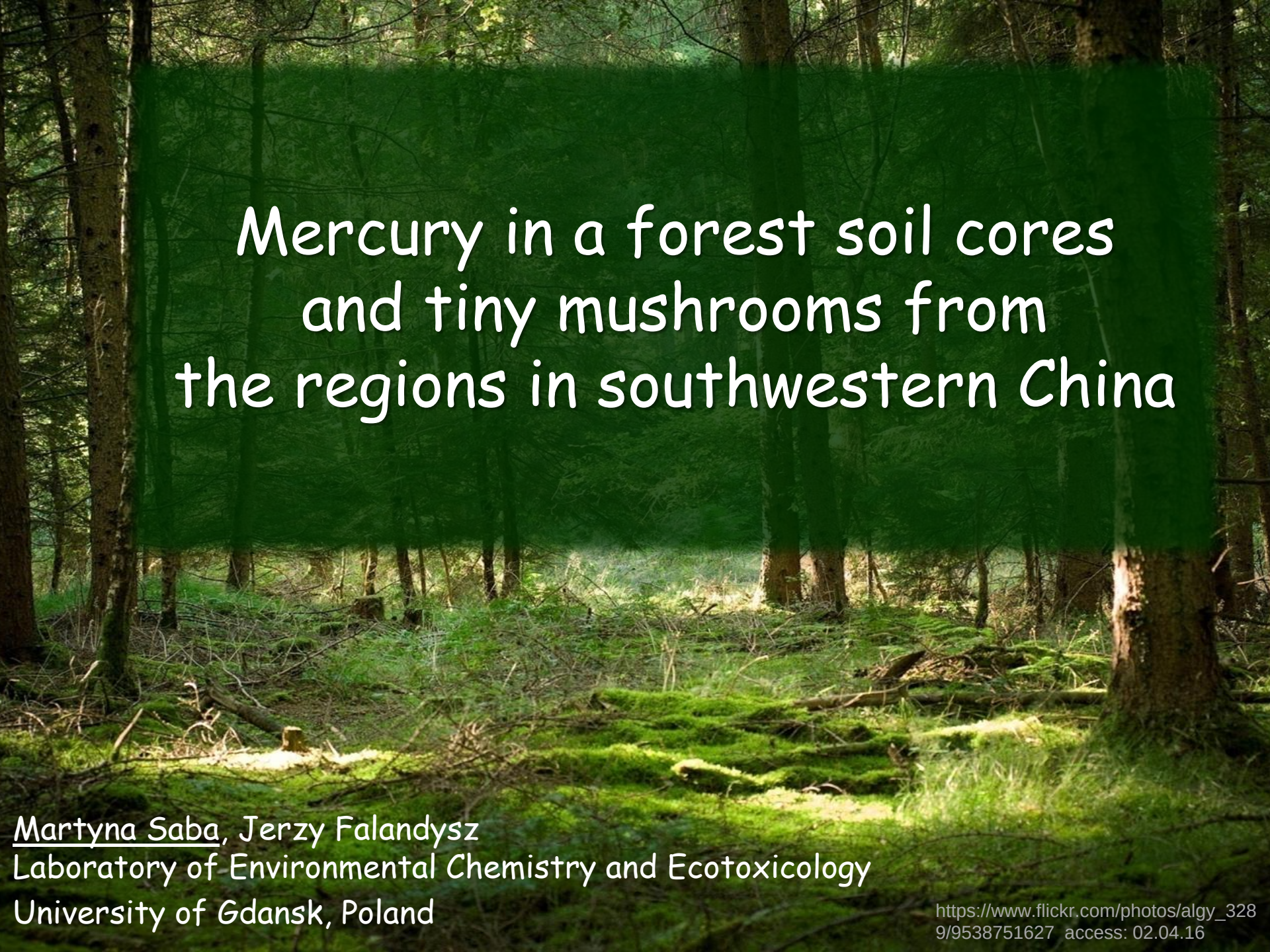


Mercury in a forest soil cores and tiny mushrooms from the regions in southwestern China

Martyna Saba, Jerzy Falandysz
Laboratory of Environmental Chemistry and Ecotoxicology
University of Gdansk, Poland

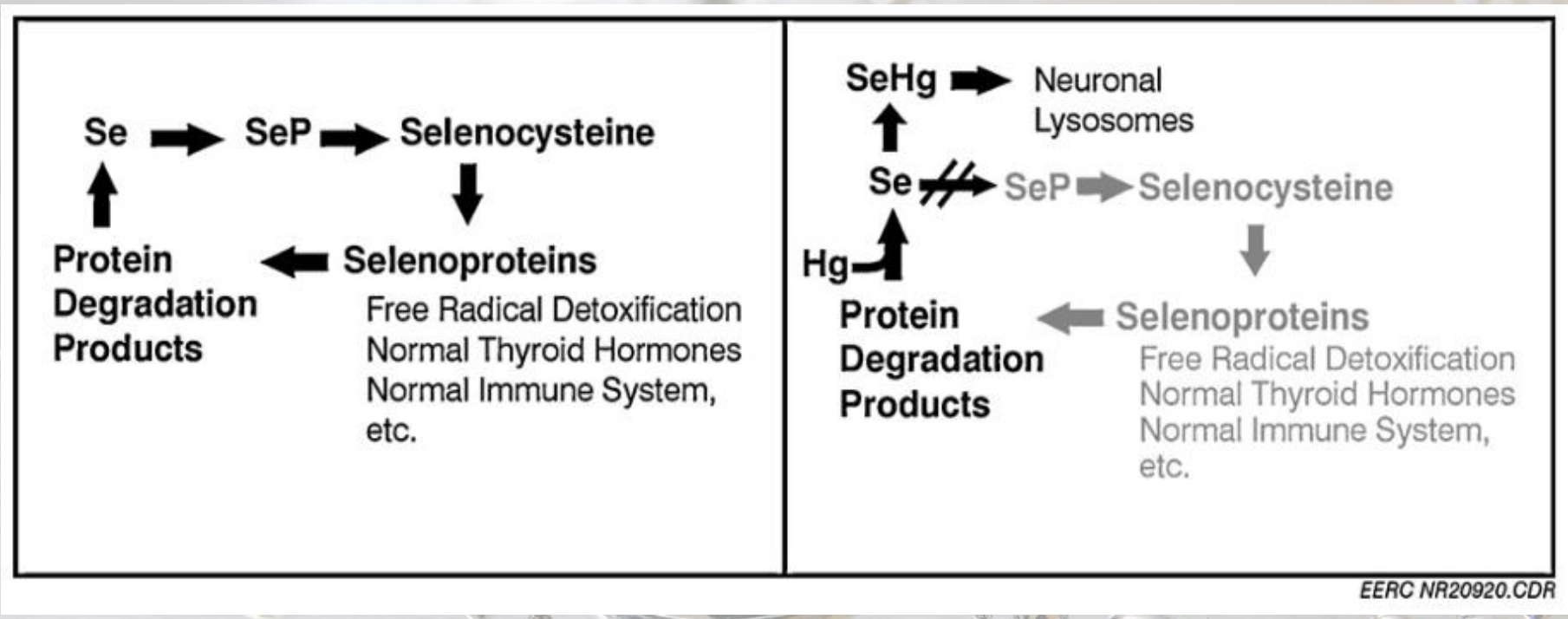
https://www.flickr.com/photos/algy_3289/9538751627 access: 02.04.16

The relative toxicity of metals to mammals

Ag, Hg, Tl, Cd > Cu, Pb, Co, Sn, Be > In, Ba > Mn, Zn, Fe, Cr > Y, La > Sr, Sc > Cs, Li, Al

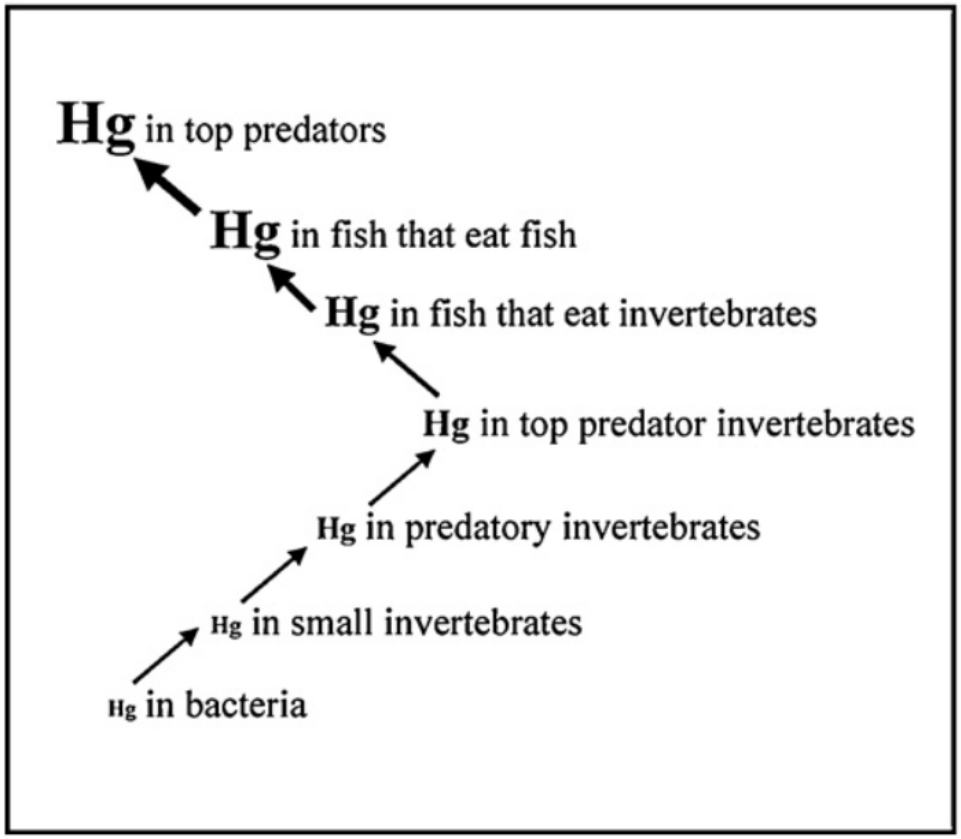
Niebor & Richardson (1980)
Envimn Poll Ser B

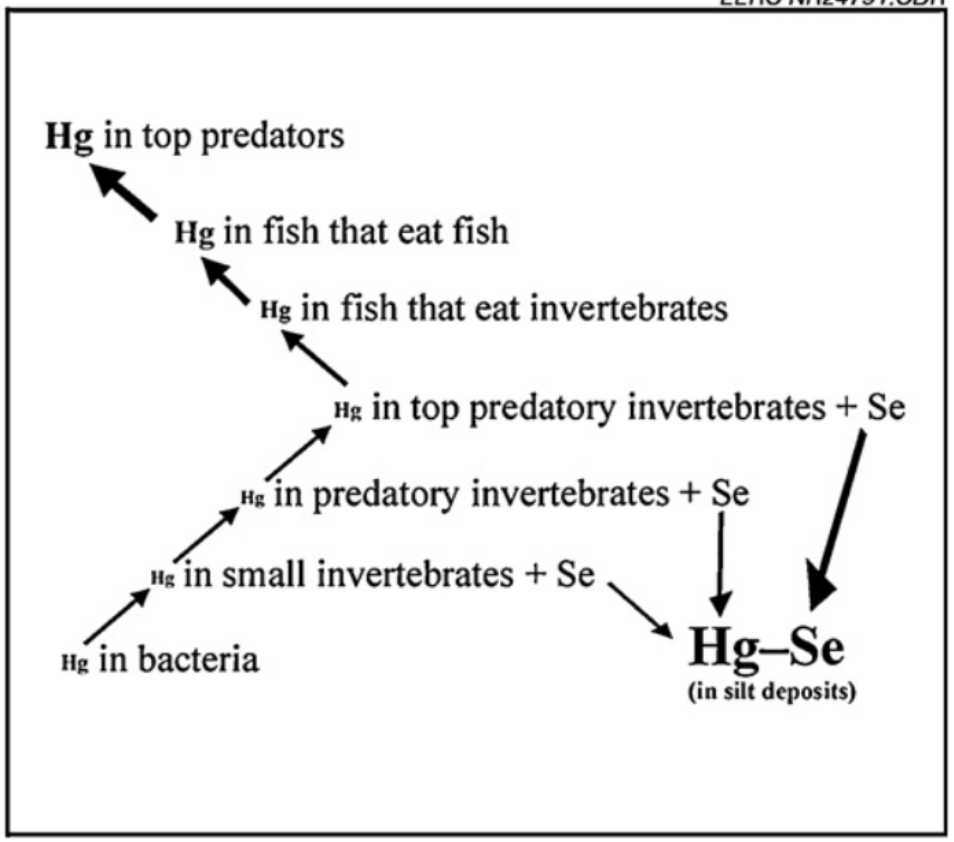
http://ehp.niehs.nih.gov/wp-content/uploads/2013/09/121N10_SOI_background.png
access: 09.04.16



High mercury (methylmercury; CH_3Hg) exposures leads to oxidative damage in brain tissues because Hg sequesters Se and thereby inhibits the activities of selenoenzymes which are vitally important for brain health and functions.

http://ehp.niehs.nih.gov/wp-content/uploads/2013/09/121N10_SOI_background.png
access: 09.04.16



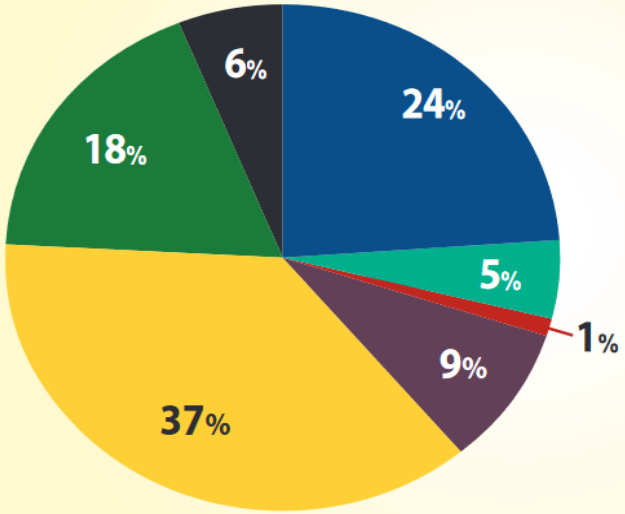


Hg bio-accumulation in low-Se vs. Se-rich ecosystem.

Hg bioaccumulation (primarily as MeHg-Cys) is greatly accentuated in fish from low-Se aquatic ecosystems. Se availability in the ecosystem is directly proportional to formation of HgSe, a poorly absorbed and biologically unavailable form that is retired to the sediments rather than bio-accumulated.

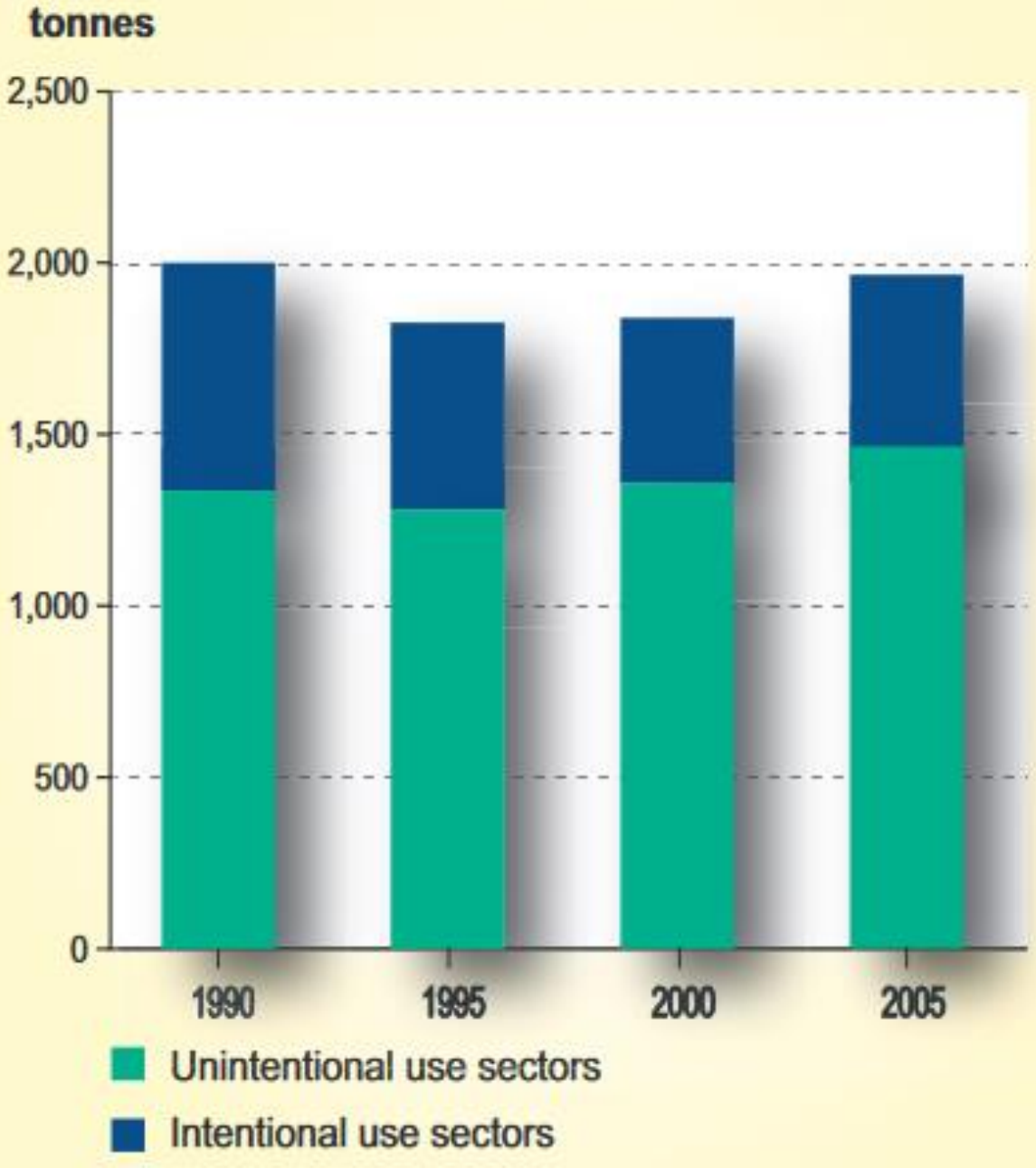
http://pulsarplanet.pl/user/images/1420713047__DSC0025.jpg
access: 09.04.16

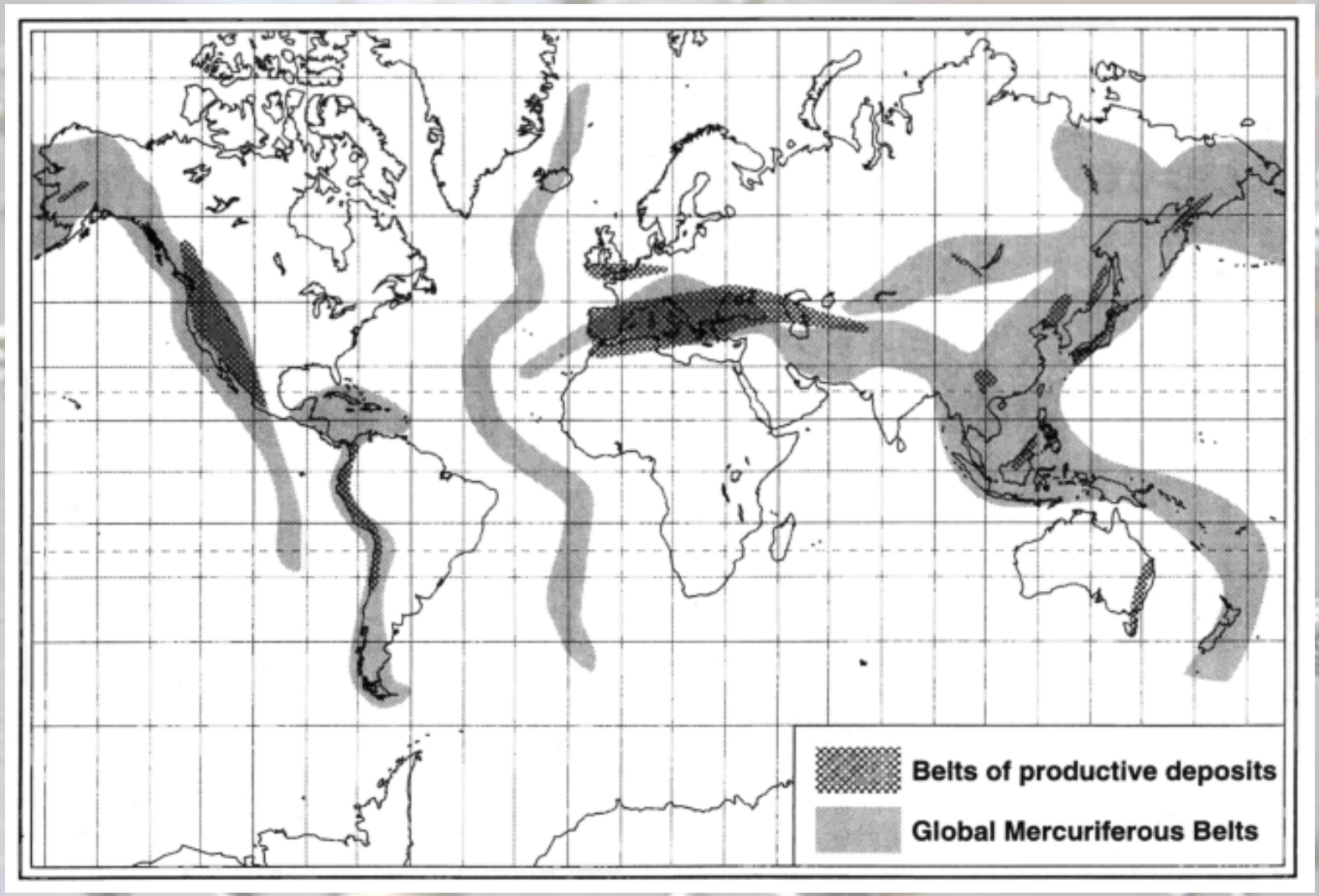
Global anthropogenic mercury emissions in 2010



- Fossil fuel combustion (power & heating)
- Metal production (ferrous & non-ferrous)
- Chlor-alkali industry
- Waste incineration, waste & other
- Artisanal and small-scale gold mining
- Cement production
- Other

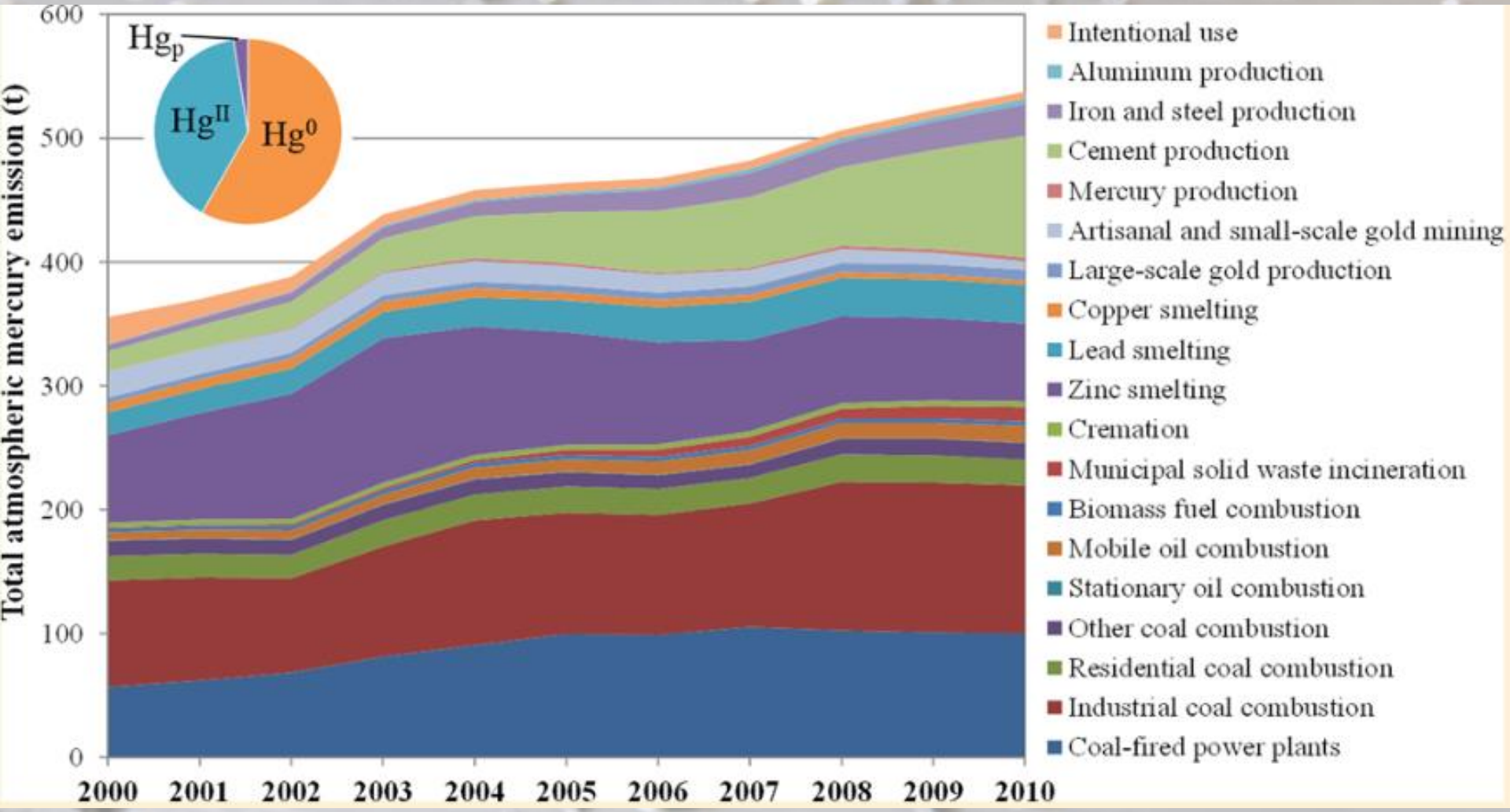
Emissions to air



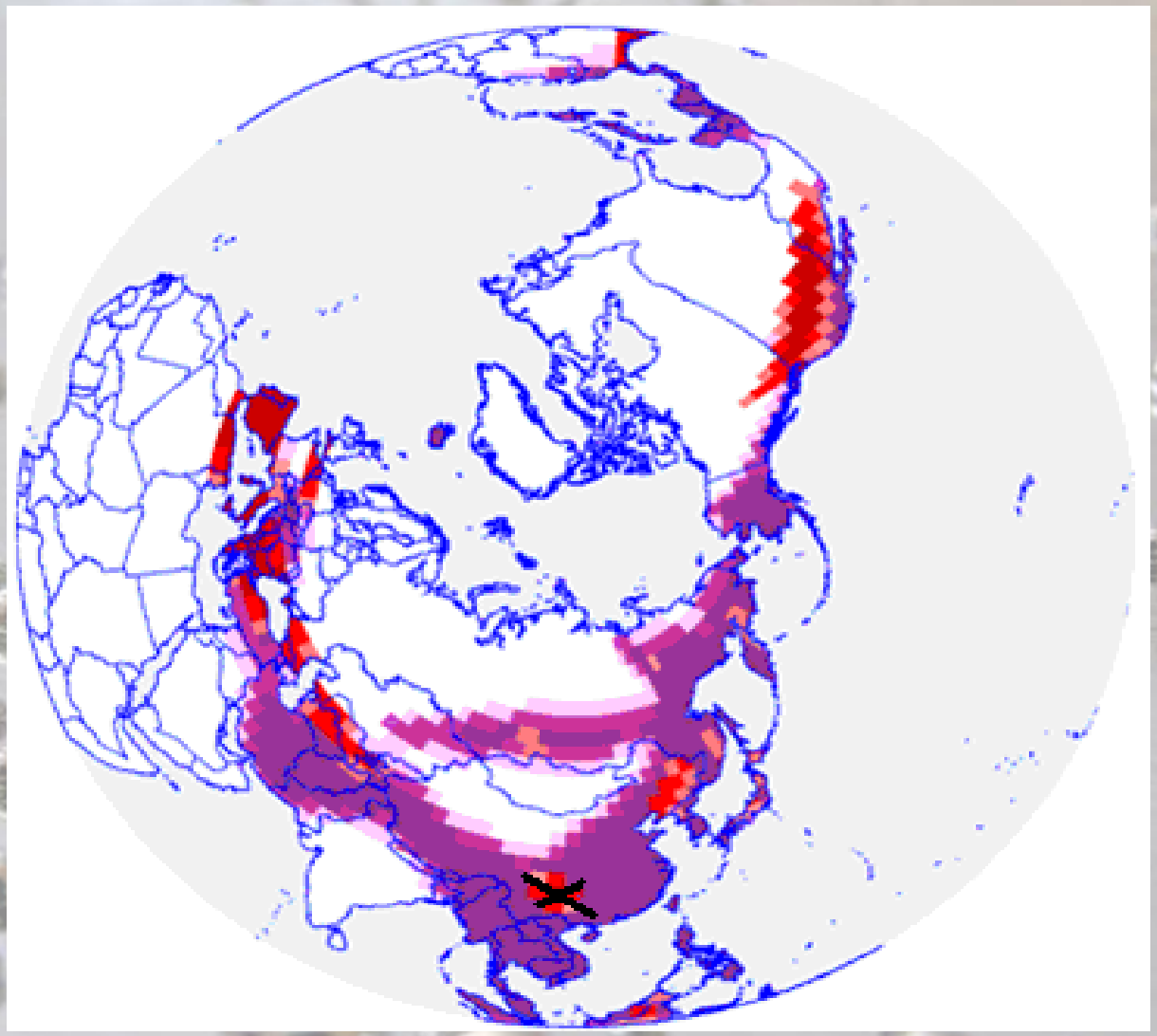


Global distribution of natural enrichment of mercury belt of productive deposits: modified from Bailey et al. [1973]. Gustin *et al*., Nevada STORMS project: Measurement of mercury emissions from naturally enriched surfaces. J. Geophys. Res. 104 (1999), pp. 21831-21844.

Estimated emission of Hg into atmosphere and sources in China

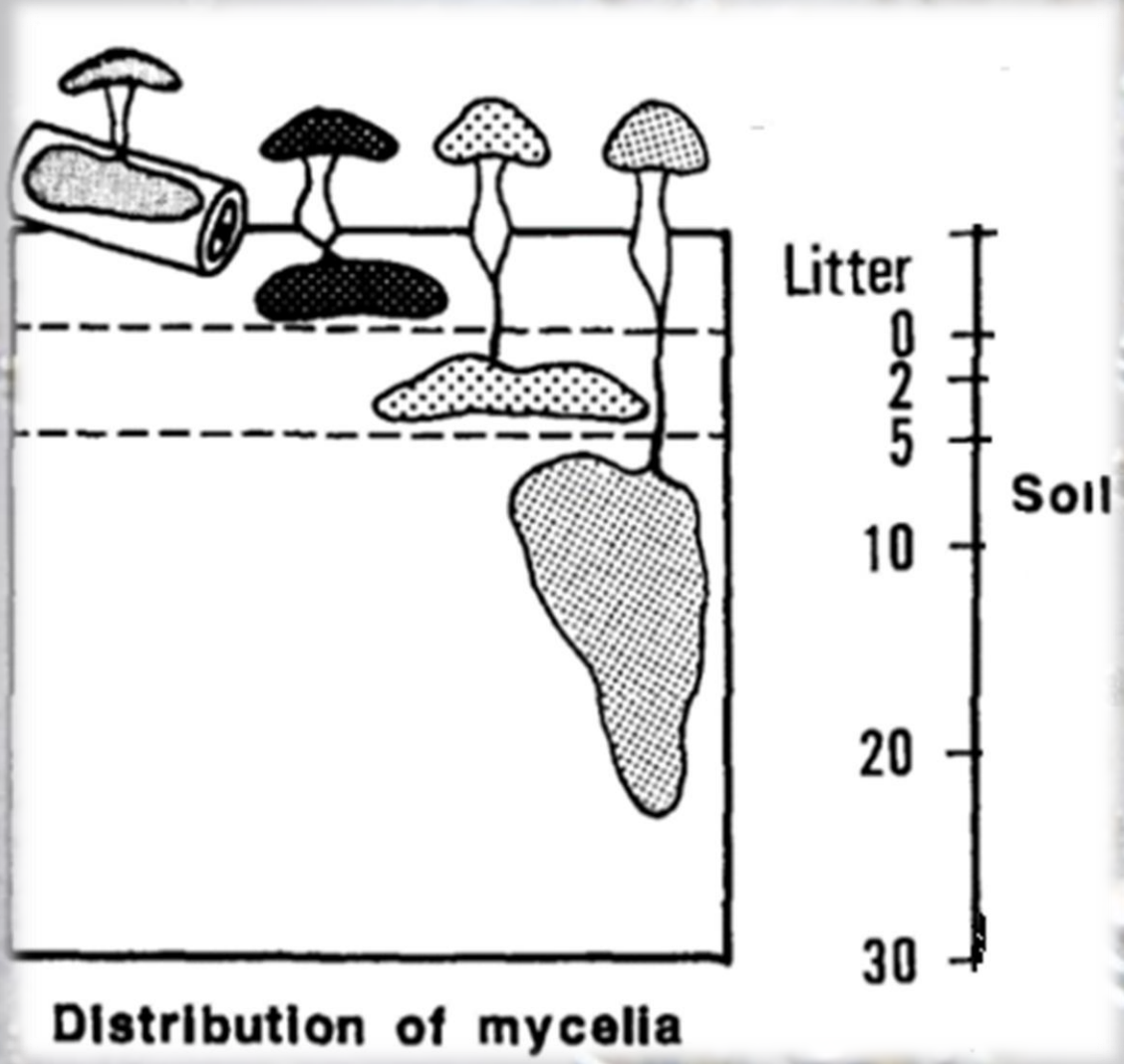


Source: Zhang et al. Environ. Sci. Technol. 2015, 49, 3185 − 3194



Global mercuriferous belts (magenta) and productive deposits areas (red).

Dutchak et al. 2003.

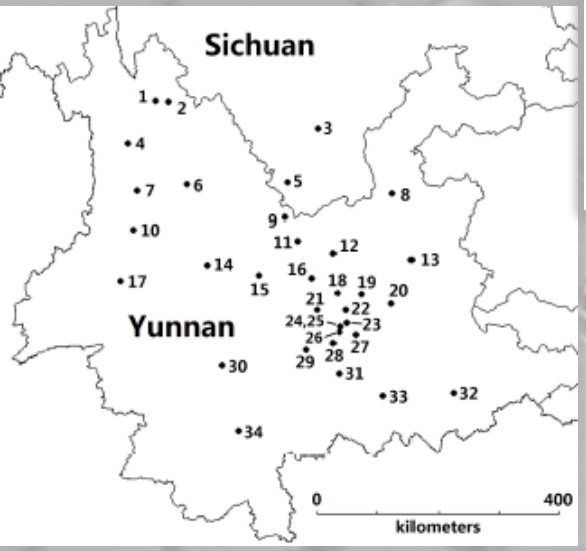


Distribution of mycelia

Mycelium which is the devise of mushroom actively absorbing minerals from the substrates.

Two organic layers in superficial soil horizons (O + Ah) are considered as the major layers where saprobic mushrooms usually take up nutrients.

Mercury in random samples of forest topsoils underneath Boletus mushrooms in Yunnan



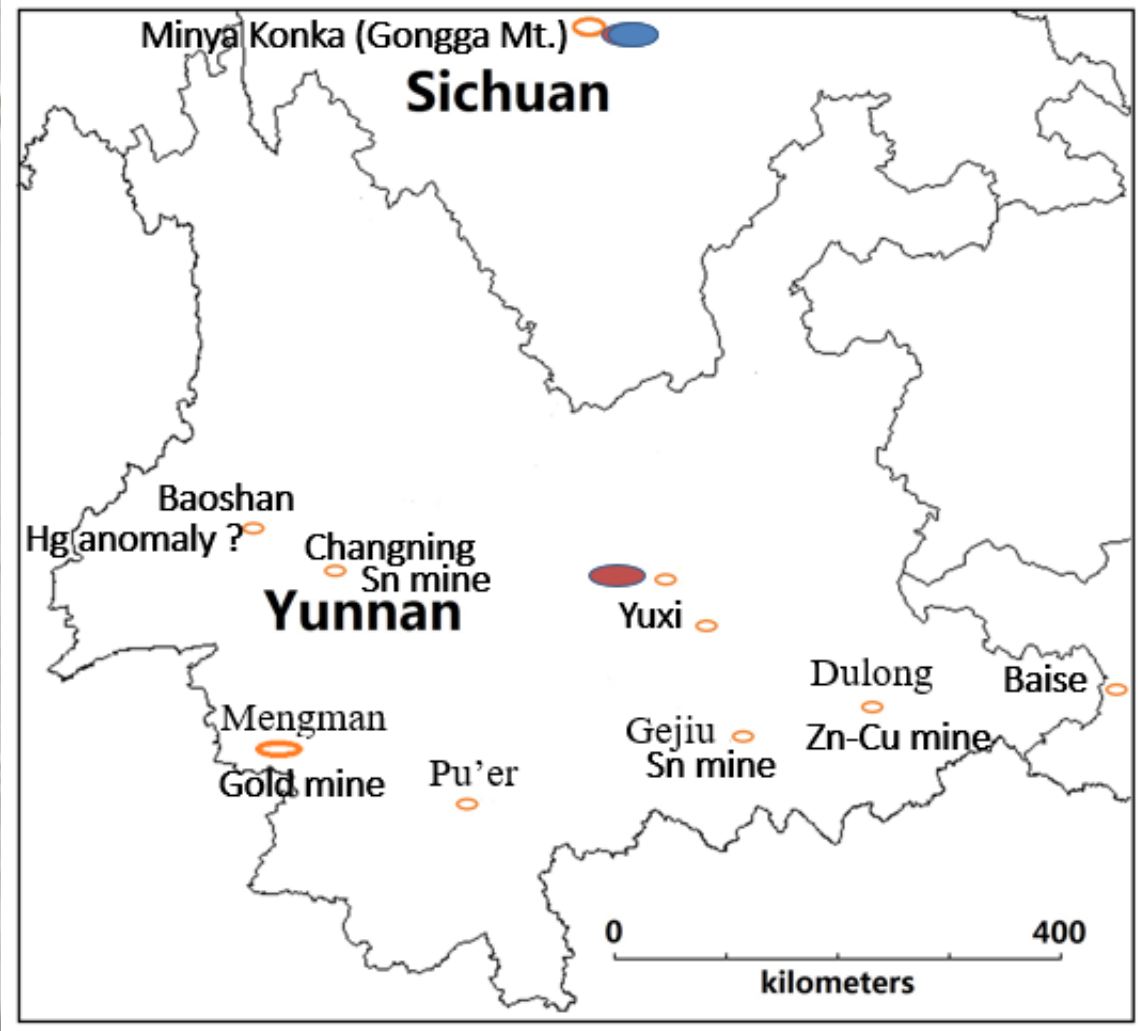
Dayingjie region [26]: **3.4** mg kg^{-1} dm
Long yang region [17]: **2.1** mg kg^{-1} dm
Yunlong in Dali region [10]: **2.6** mg kg^{-1} dm
Lanping region, Nujiang [7]: **2.4** mg kg^{-1} dm
Several regions with Hg at > **1.0** mg kg^{-1} dm

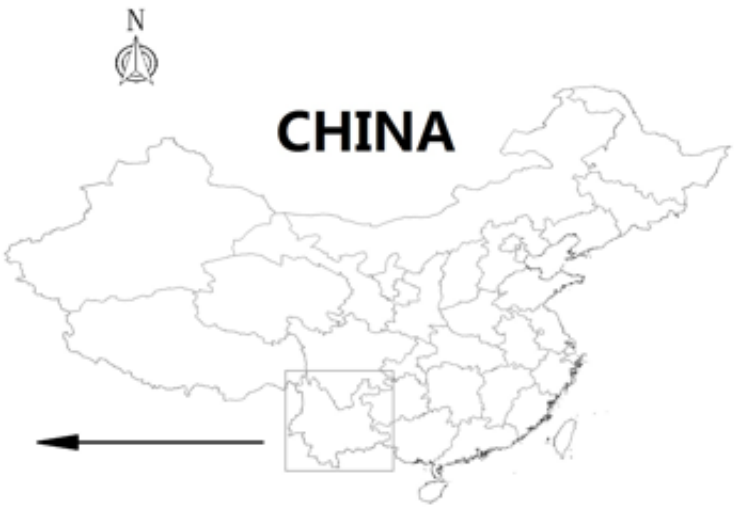
Materials and Methods

Sampling sites of soil and fungal materials

Sampling site	Coordinates	Altitude (m a.s.l.)	Materials
Minya Konka	101°59'14"E, 29° 34'45"N	3600 m	Mushrooms/soil
Minya Konka	101°59'54"E, 29° 34'34"N	3000 m	Mushrooms/soil/litter
Minya Konka	101°59'59"E, 29° 34'29"N	2600 m	Mushrooms/soil/litter
Baoshan	25°27’53”N, 98°57’23”E	1976 m	Soil core
Changning	24°43’44”N, 99°45’4”E	1950 m	Soil core
Mengman	22°10’35”N, 100°7’47”E	908 m	Soil core
Gejiu	23°13’24”N, 103°8’29”E	1971 m	Soil core
Dulong	22°53’21”N, 104°32’52”E	915 m	Soil core
Baise	23°54’35”N, 106°14’55”E	268 m	Soil core
Hongta, Yuxi	23°55’22°N, 102°08’55”E	~1600	Mushrooms/soil cores
Zhenyuan, Pu’er	24°26°45°N, 100°33’36”E	~1400	Mushrooms/soil core

Map with sampling sites of soil and fungal materials





Sampling sites of soil cores

Sampling sites of mushrooms

Sampling site of soil

Analytical Method

The determinations of total Hg content of fungal and soils samples was performed using cold-vapour atomic absorption spectroscopy by a direct sample thermal decomposition coupled with gold wool trap of Hg and its further desorption and quantitative measurement at wavelength of 253.7 nm.

The analytical instrument used was mercury analyzer (MA-2000, Nippon Instruments Corporation, Takatsuki, Japan) operated respectively at low (3 to 20 ng Hg per sample) and high (25 to 150 ng Hg per sample) mode.

Summary of results of Hg determination in fungal certified reference materials

(mg kg^{-1} dry matter)

Certified reference material	Declared Hg concentration	Determined Hg concentration
CS-M-1	0.174±0.018	0.18±0.01 (n=13)
CS-M-2	0.164±0.004	0.16±0.01 (n=8)
CS-M-3	2.849±0.104	2.8±0.0 (n=5)
CS-M-4	0.465±0.024	0.45±0.03 (n=14)

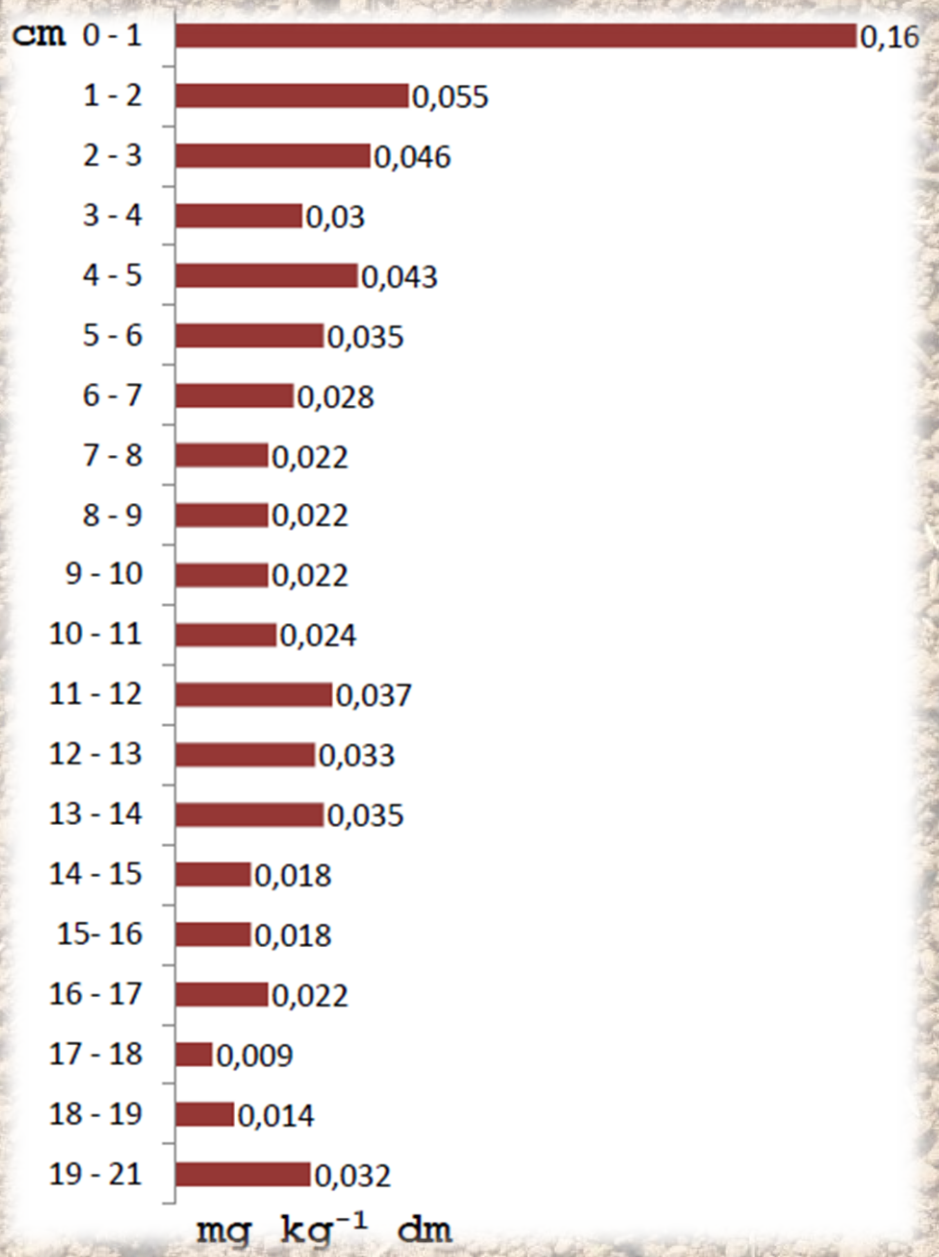
CS-M-1 ;dried mushroom powder (*Suillus bovinus*)
CS-M-2 ;dried mushroom powder (*Agaricus campestris*)
CS-M-3 ;dried mushroom powder (*Boletus edulis*)
CS-M-4 ;dried mushroom powder (*Leccinum scabrum*)
[produced by the Institute of Nuclear Chemistry and Technology, Warsaw, Poland]

Results and Discussion

Mercury (mg kg^{-1} dm) in soil core: Yunnan, city of Yuxi, Hongta region.

Layers with organic matter (0-3 cm) and > 3 cm rocky background

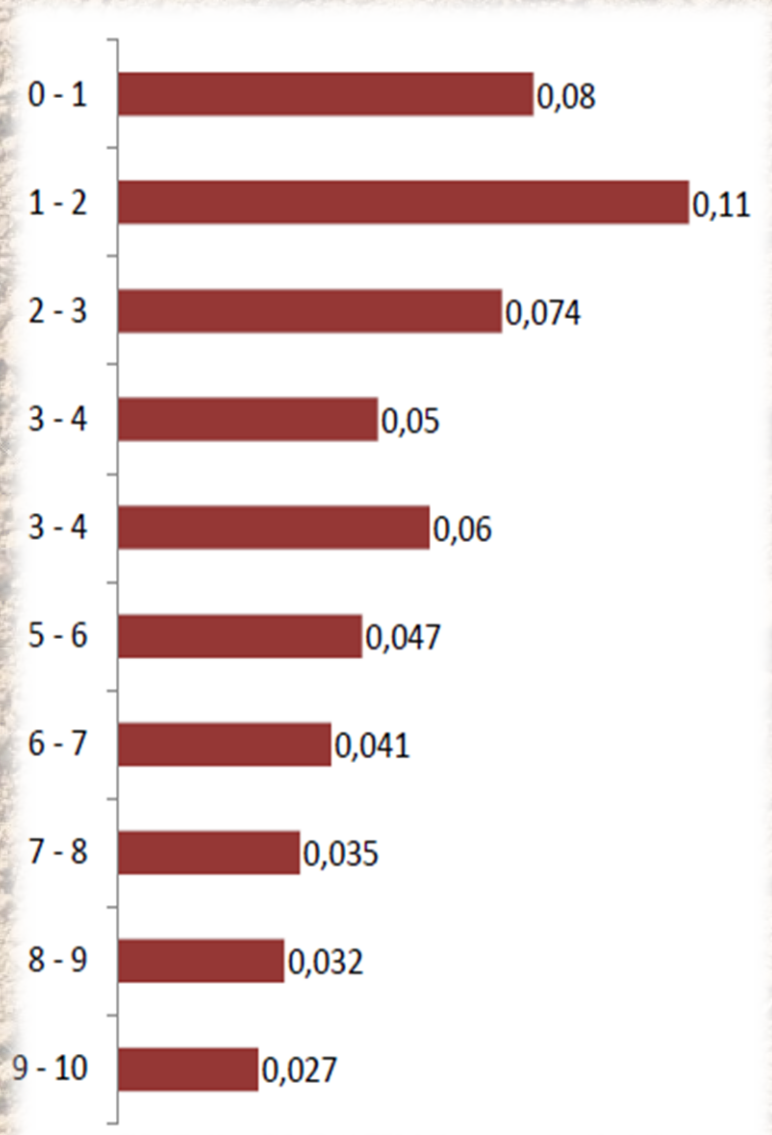
Layer (~250 cm) 0.0078 mg kg^{-1} dm)
Layer (~300 cm) 0.020 mg kg^{-1} dm)

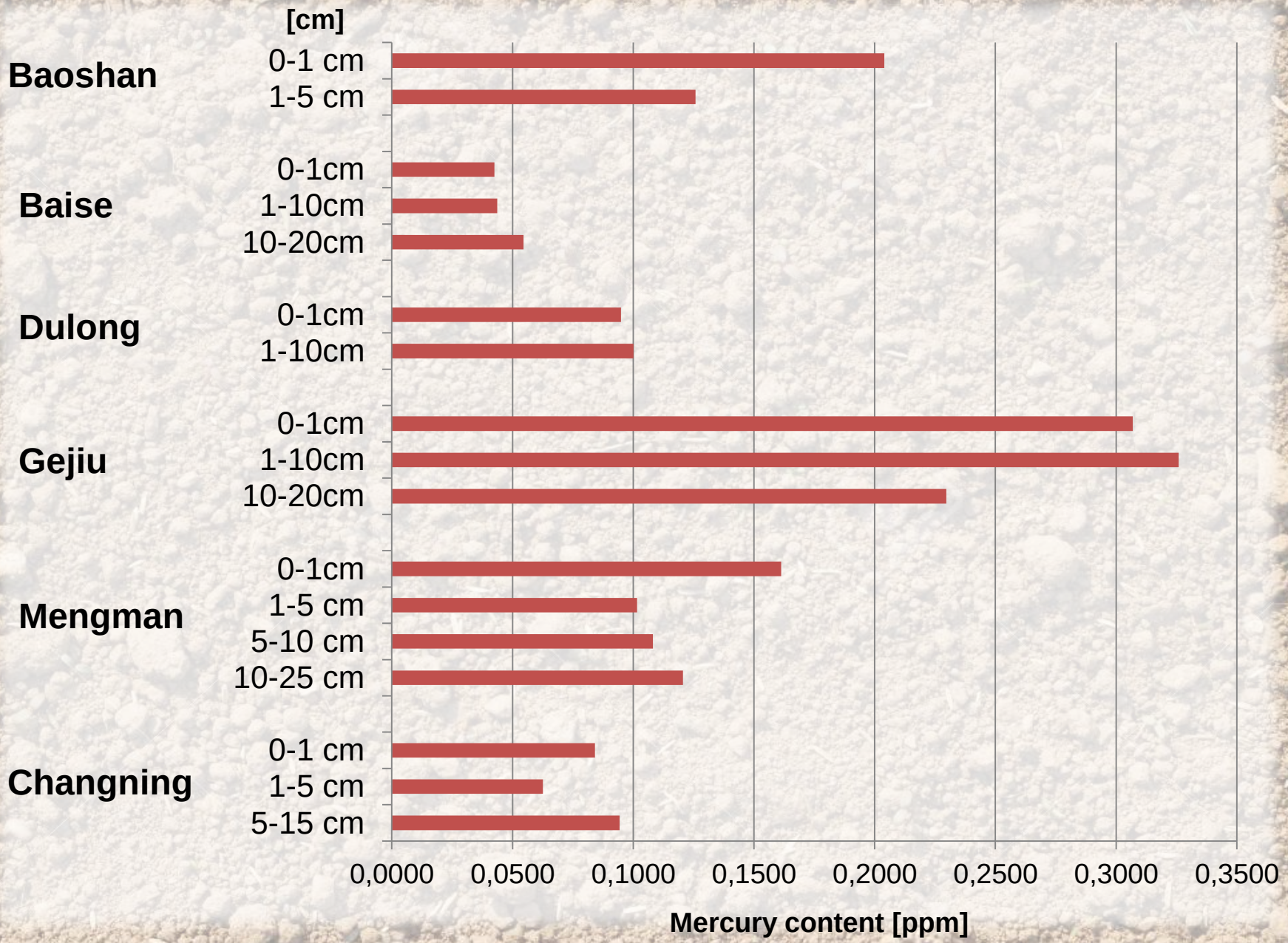


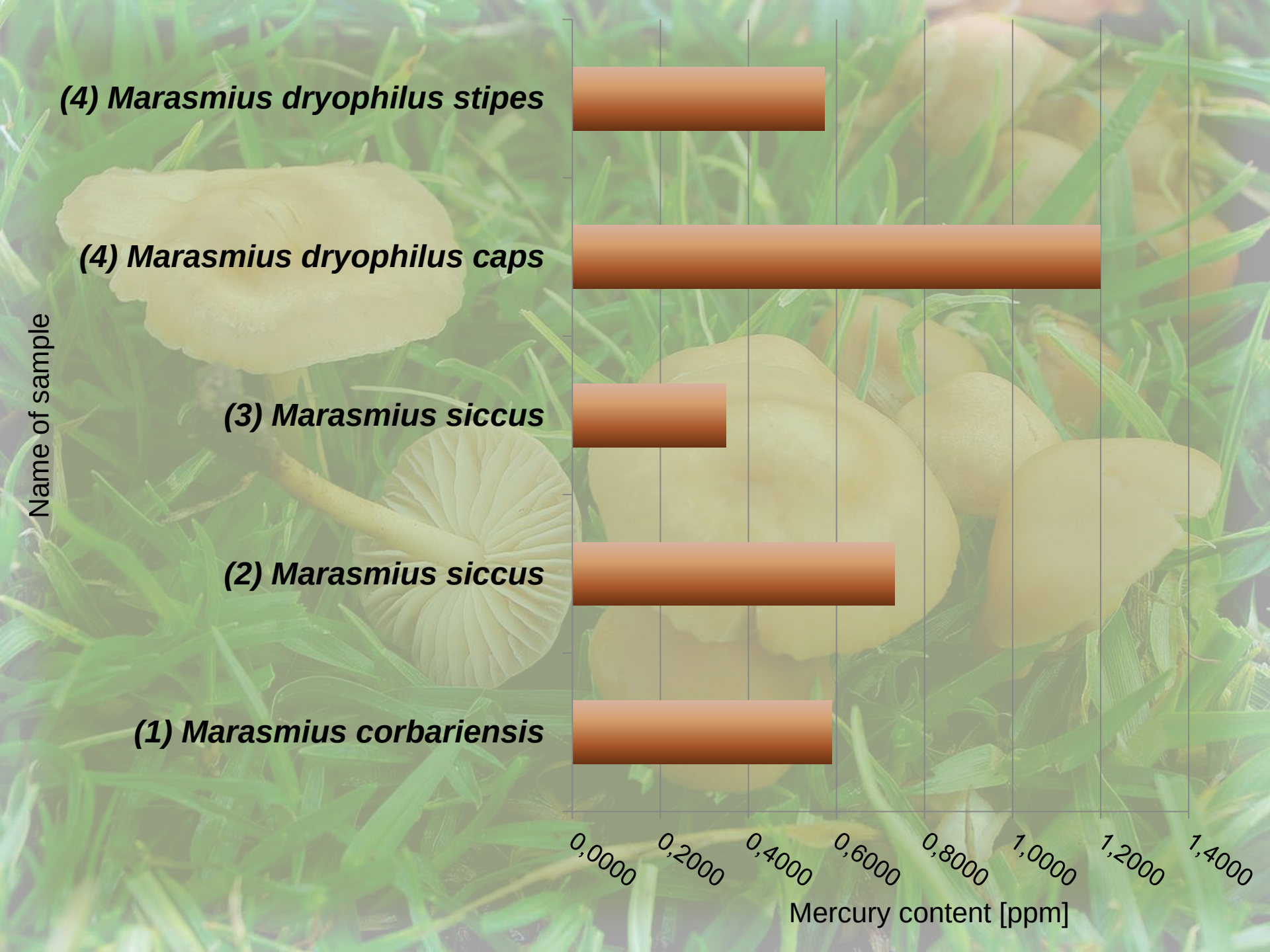
Mercury (mg kg^{-1} dm)
in forest soil core

Yunnan, Pu'er county
(coordinates: 23° 48'46,6"N//100° 43'25,8"E)

Layers with organic matter (0-3cm)




[cm]
Baoshan
0-1 cm
1-5 cm
Baise
0-1cm
1-10cm
10-20cm
Dulong
0-1cm
1-10cm
Gejiu
0-1cm
1-10cm
10-20cm
Mengman
0-1cm
1-5 cm
5-10 cm
10-25 cm
Changning
0-1 cm
1-5 cm
5-15 cm
0,0000
0,0500
0,1000
0,1500
0,2000
0,2500
0,3000
0,3500
Mercury content [ppm]


(4) Marasmius dryophilus stipes
(4) Marasmius dryophilus caps
(3) Marasmius siccus
(2) Marasmius siccus
(1) Marasmius corbariensis
Name of sample
0,0000
0,2000
0,4000
0,6000
0,8000
1,0000
1,2000
1,4000
Mercury content [ppm]

Thank you for your attention

http://images.medicaldaily.com/sites/medicaldaily.com/files/2014/09/11/mushroom.jpg
access: 04.04.16