



**HANNOVER**  
**2.– 6.3.2010**  
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## Commodity prices and the growing importance of recycling

Dr. Heinz-Jürgen Büchner  
Hannover, March 4, 2010

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# Agenda

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2

1. Waste electric / electronic equipment: the other side of information technology and the mines of the future
2. Precious metals: scarcity of raw materials
3. Short-term commodity price outlook

## Mobile phones: a secondary reserve base of precious metals

3

Mobile phones are resources, not waste!



### Components of mobile phones

1.3 bn. mobile phones contain:

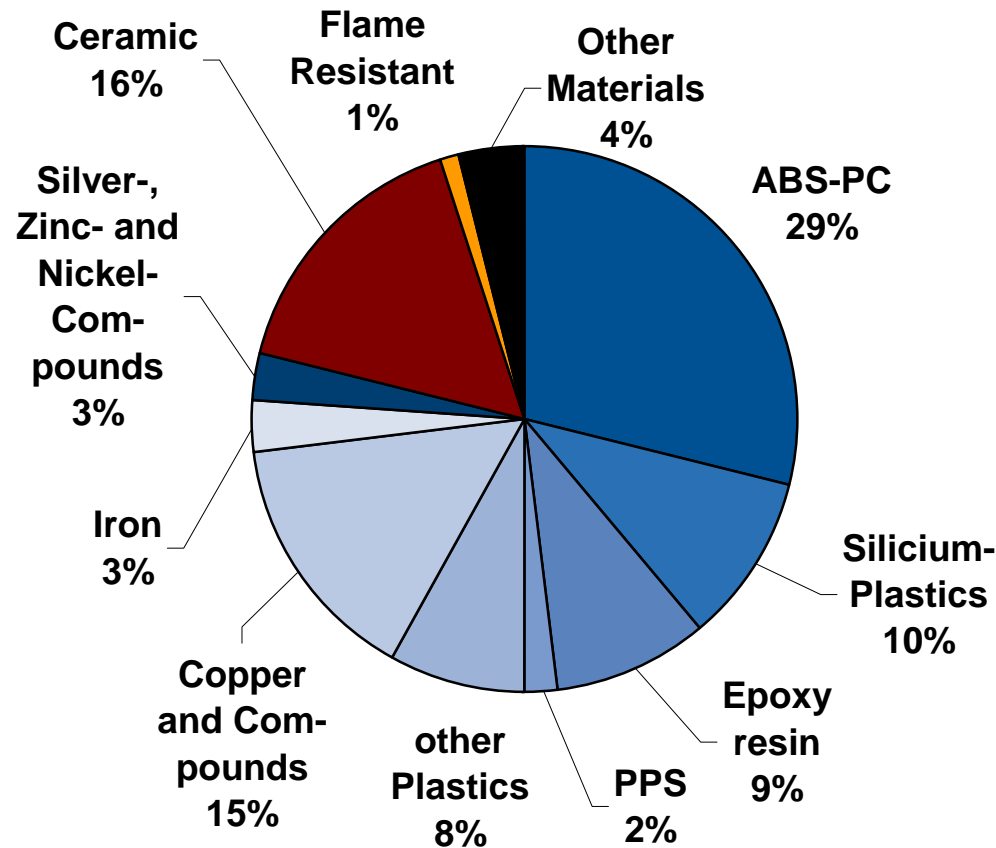
- 325 tons of silver:  
the equivalent of 1.6 % of total mine production in 2008
- 31 tons of gold:  
the equivalent of 1.3 % of total mine production in 2008
- 12 tons of palladium:  
the equivalent of 5.9 % of total mine production in 2008
- 12,000 tons of copper:  
the equivalent of 0.1 % of total mine production in 2008
- 4,900 tons of cobalt:  
the equivalent of 7.5 % of total mine production in 2007

Sources: U.S. Geological Survey, Mineral Commodity Summaries, own calculations

# Components of an average mobile phone

2010

in %



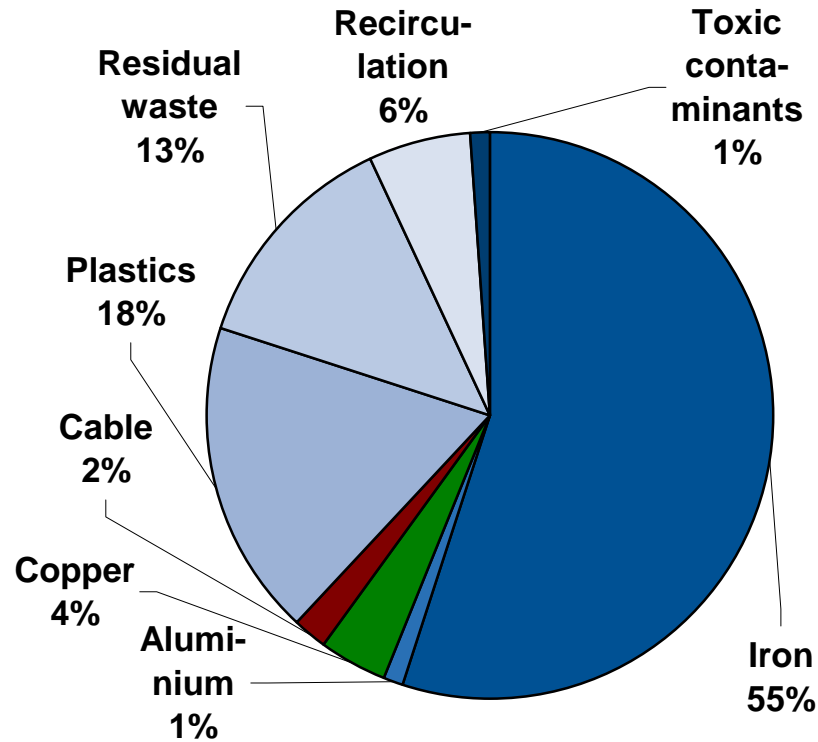
Source: Nokia

## Recycling and energetic use

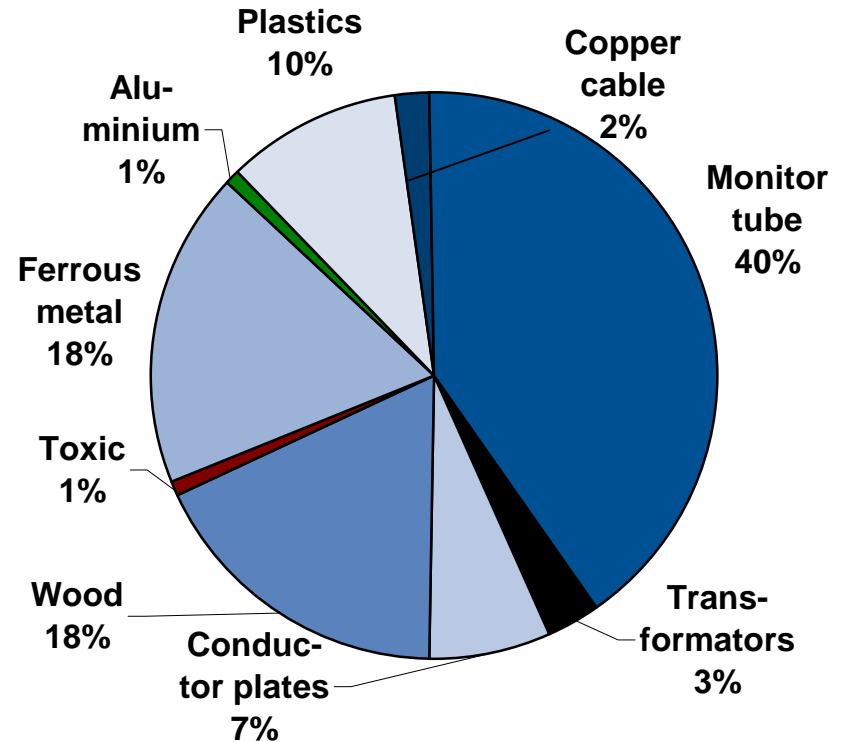
- Meanwhile, half of a mobile phone is built from different types of plastics
- If a recycling of these plastics is not possible, an energetic use is the alternative
- There is no alternative to recycling precious, ferrous and non-ferrous metals

# Electronic devices: components are not only waste

Minor devices



TV devices



Sources: IPA, IKB estimation

## Precious metal content in printed circuit boards

6

### Gram per ton in selected electronic devices

Printed circuit boards of ...	Silver	Gold	Palladium	Platinum
DVD-Player	700	100	21	0
PC	700	600	100	40
PC-Keyboard with Mouse	700	70	30	0
Small IT- and Communication Devices	5700	1300	470	0

### Recycling will become profitable

- Recycling activities must be intensified as a result of limited reserves of precious metals
- Recycling will be more profitable with higher prices of precious metals
- The mines of the future are the landfills of today

Sources: Müll und Abfall; TU Berlin



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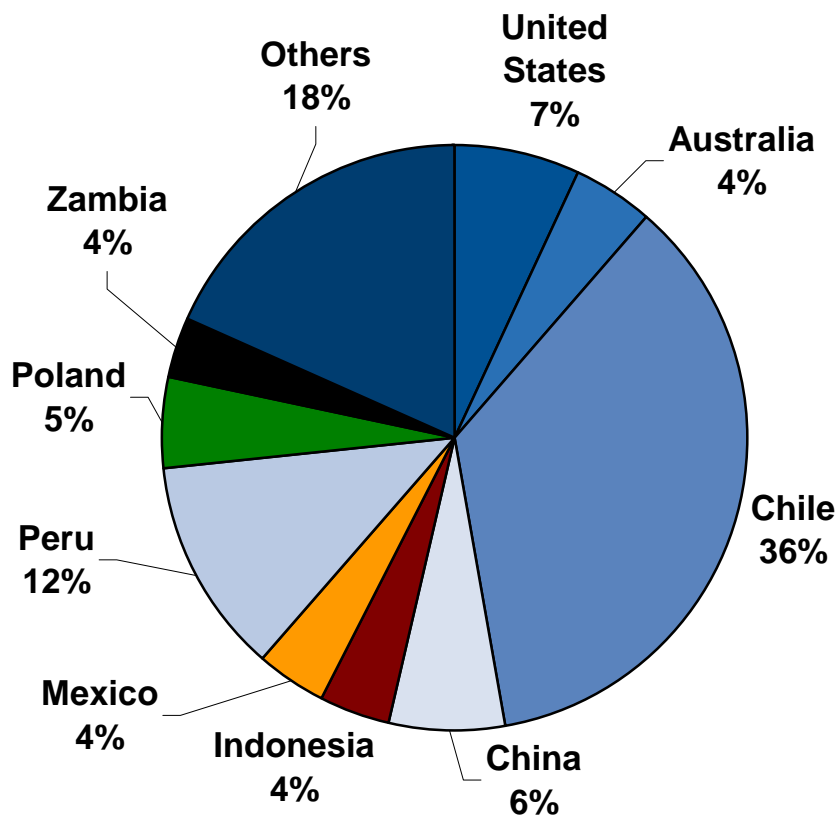
1. Waste electric / electronic equipment: the other side of information technology and the mines of the future
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## Copper: a reserve base of 1 bn. ton

8

### 2009 estimated reserve base

in %



Source: U.S. Geological Survey

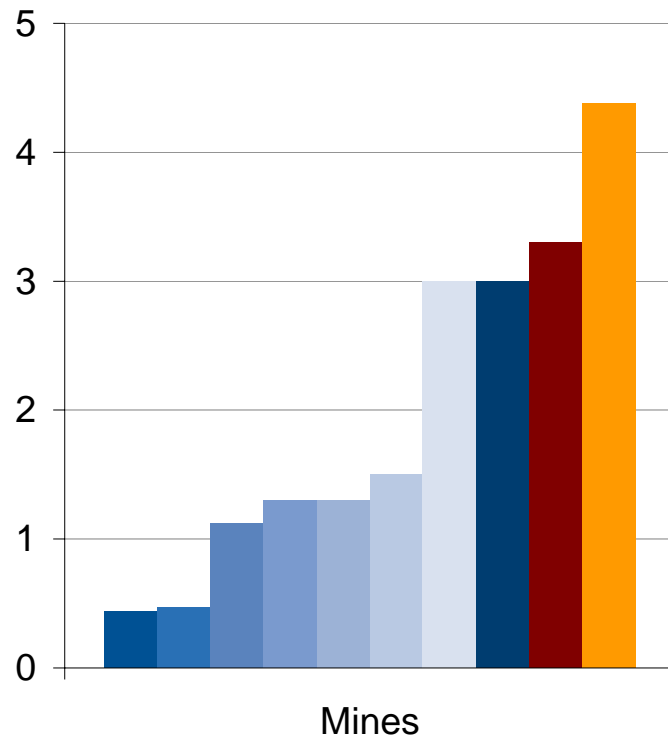
### Current production insufficient

- Total copper mines production of was 15.5 mill. tons in 2008, whereas another 2.8 mill. tons came from scrap recycling
- The proven reserves are calculated with 550 mill. tons, the reserve base is estimated with 1 bn. tons
- The current mine production is not sufficient for the future
- We forecast an increasing demand for copper coming from electric vehicles

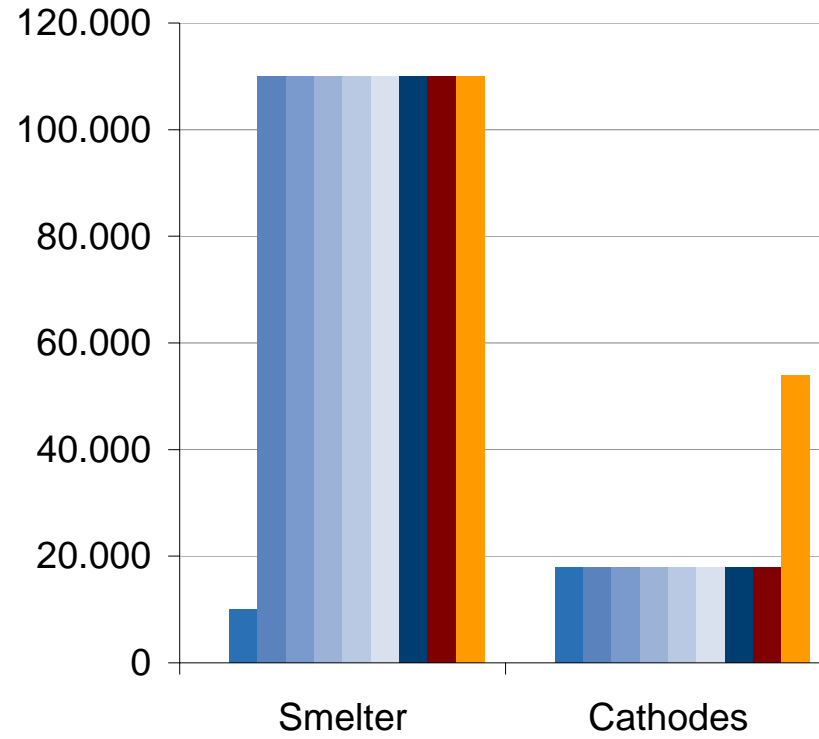
# Copper: high investments necessary

## Net Additions in Capacities

in mill. tons



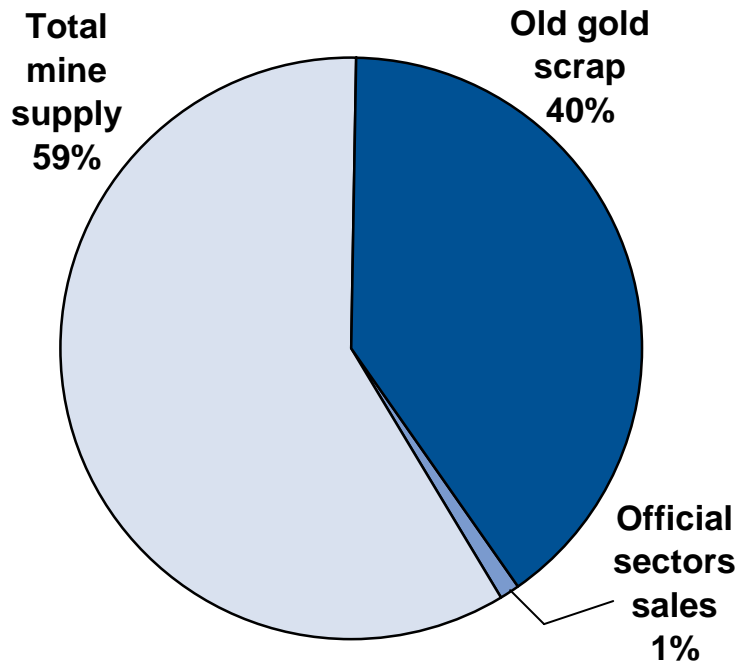
in tons



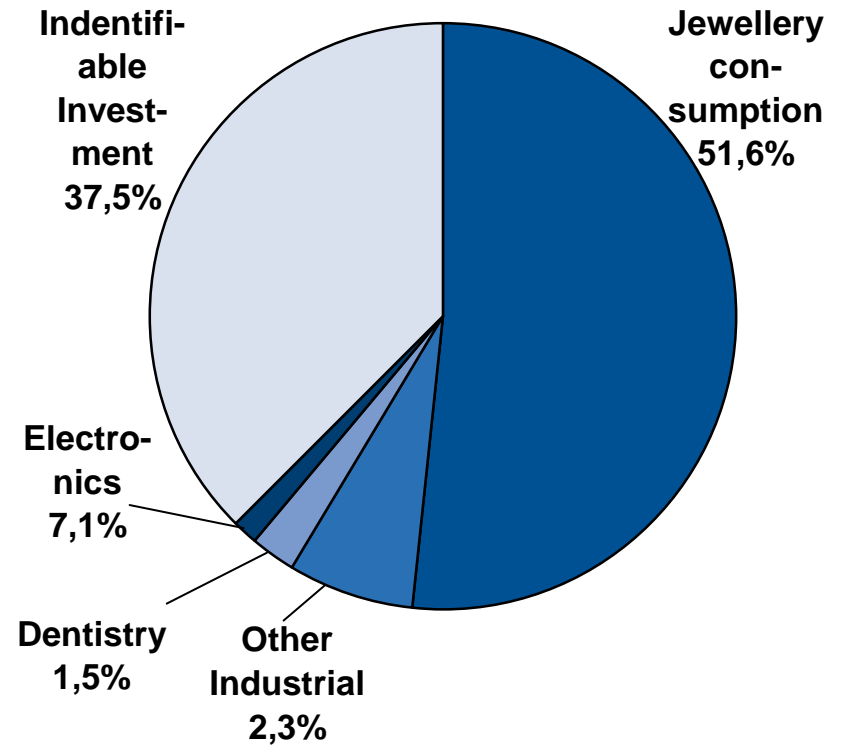
■ 2008 ■ 2009 ■ 2010 ■ 2011 ■ 2012 ■ 2013 ■ 2014 ■ 2015 ■ 2016 ■ unapproved

Sources: Annual Reports Anglo American; BHP; Rio Tinto; Vale

## Supply



## Demand



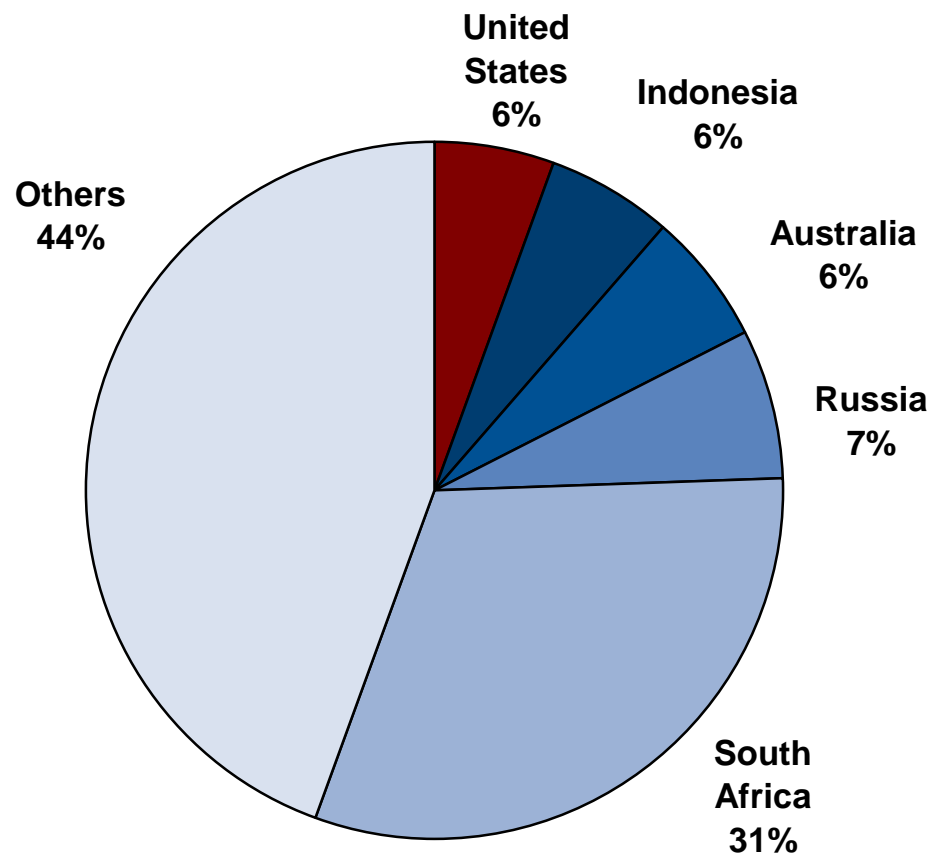
Source: GFMS Ltd.

## Gold: a reserve base of 100,000 tons

11

### 2009 estimated reserve base

in %



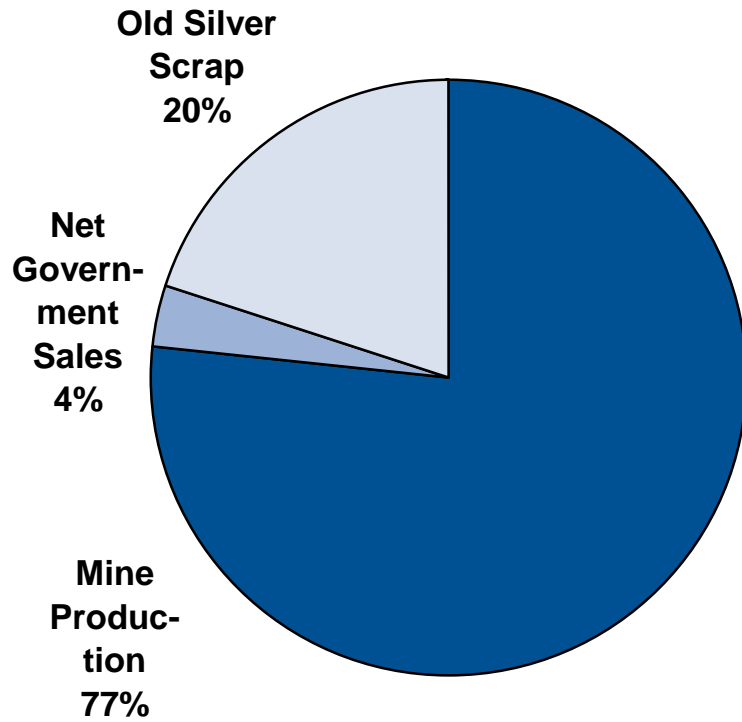
Source: U.S. Geological Survey, Mineral Commodity Summaries

### Proven reserves for 20 years

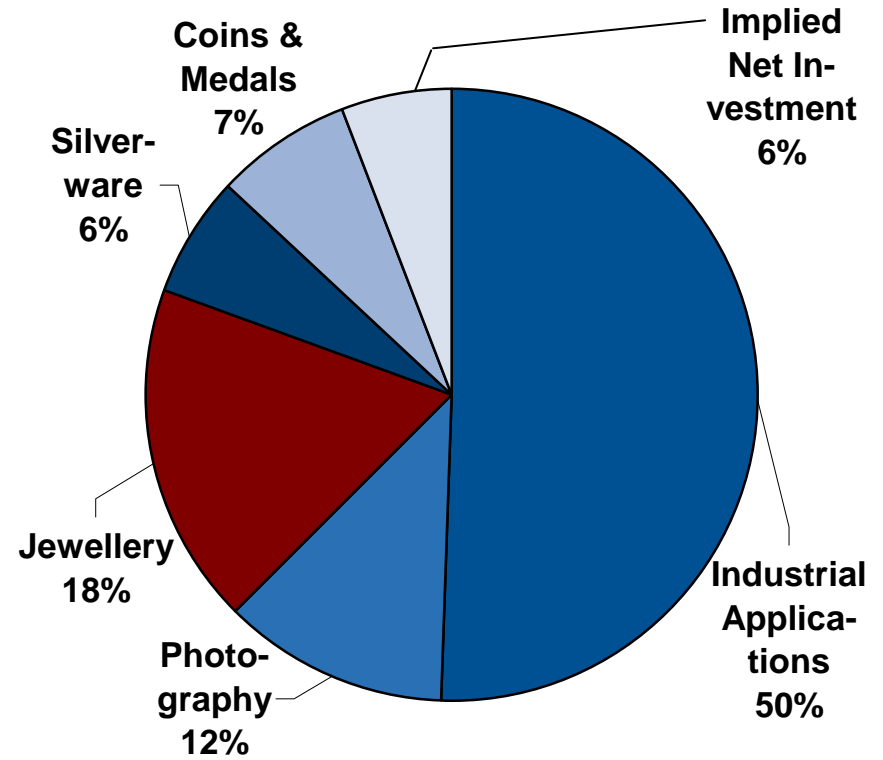
- Total gold production was 2,064 tons (net of producer hedging, in total 2,415) in 2008, another 1,200 tons came from scrap recycling
- The proven reserves are calculated with 47,000 tons, while the reserve base is estimated with 100,000 tons
- It is necessary to reduce the jewellery consumption of gold in the future
- The current price level induces a higher backflow of gold scrap and intensifies recycling activities

# Silver 2008

## Supply



## Demand



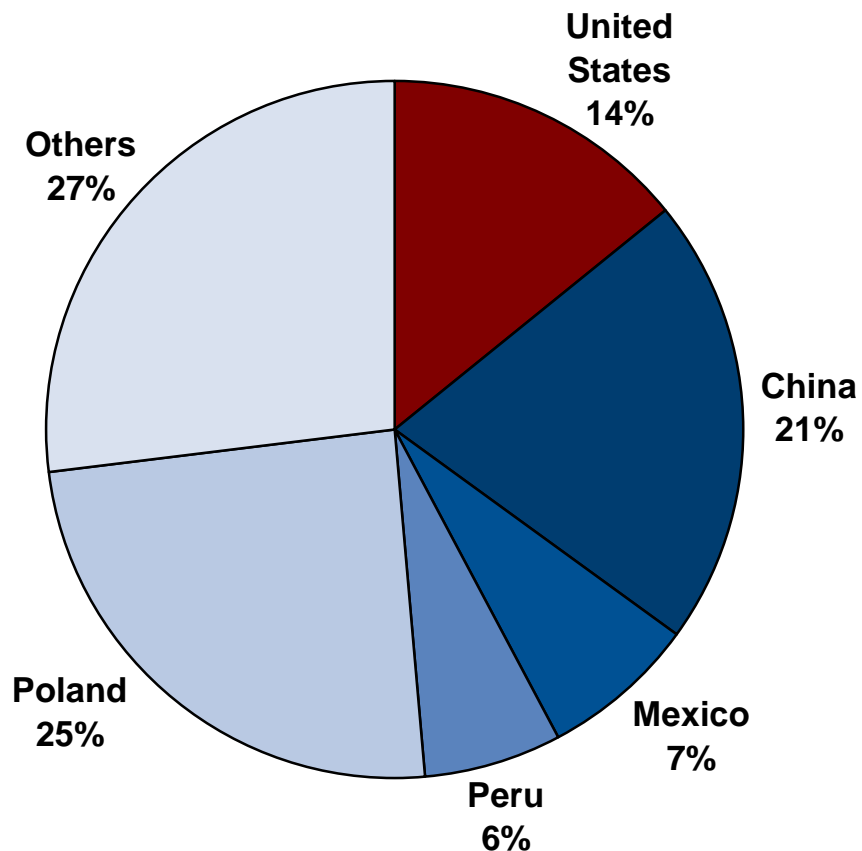
Source: The Silver Institute

## Silver: a reserve base of 570,000 tons

13

### 2009 estimated reserve base

in %



Source: U.S. Geological Survey, Mineral Commodity Summaries

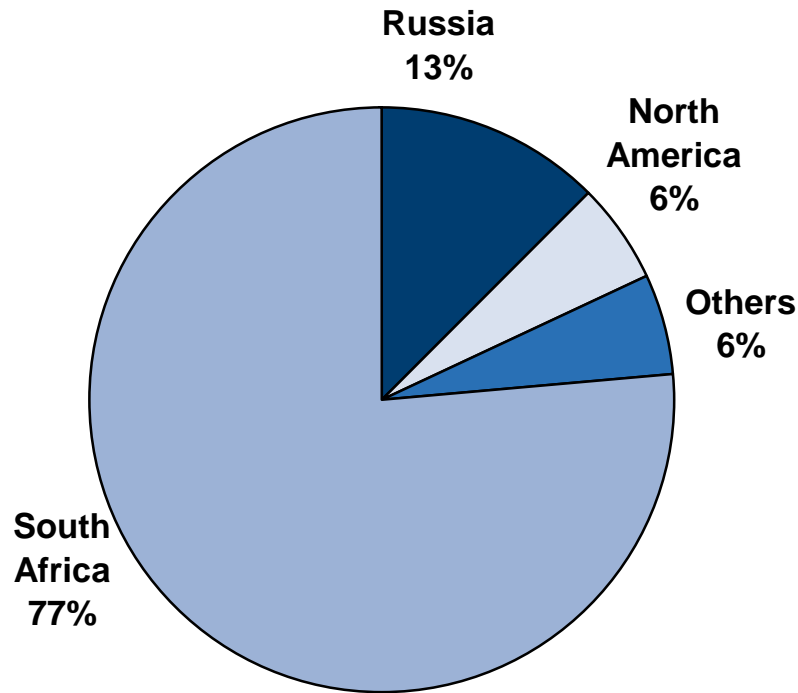
### Reserves for 25 years

- Total silver production of silver was 20,900 tons in 2008, another 5,000 tons came from scrap recycling
- The proved reserves are calculated with 270,000 tons, while the reserve base is estimated with 570,000 tons
- The reduced demand of the photographic industry reduces the backflow of scrap

# Platinum 2008

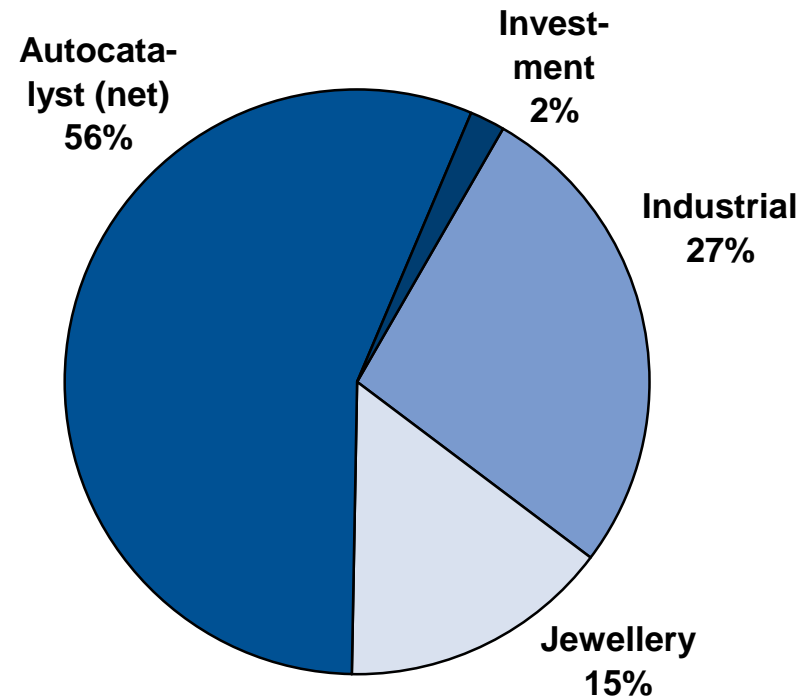
## Supply by region

Total: 6.28 million oz.



## Demand by application

Total: 6.52 million oz.



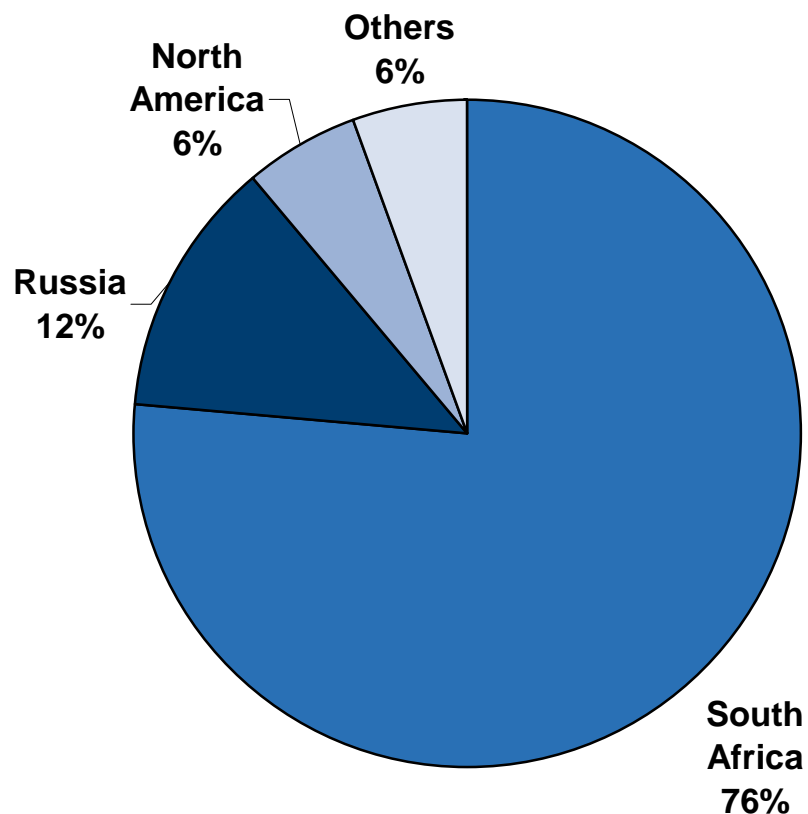
Sources: IPA, IKB estimation

## Platinum: a small reserve base

15

### 2008 estimated reserve base

in %



Sources: U.S. Geological Survey, Mineral Commodity Summaries

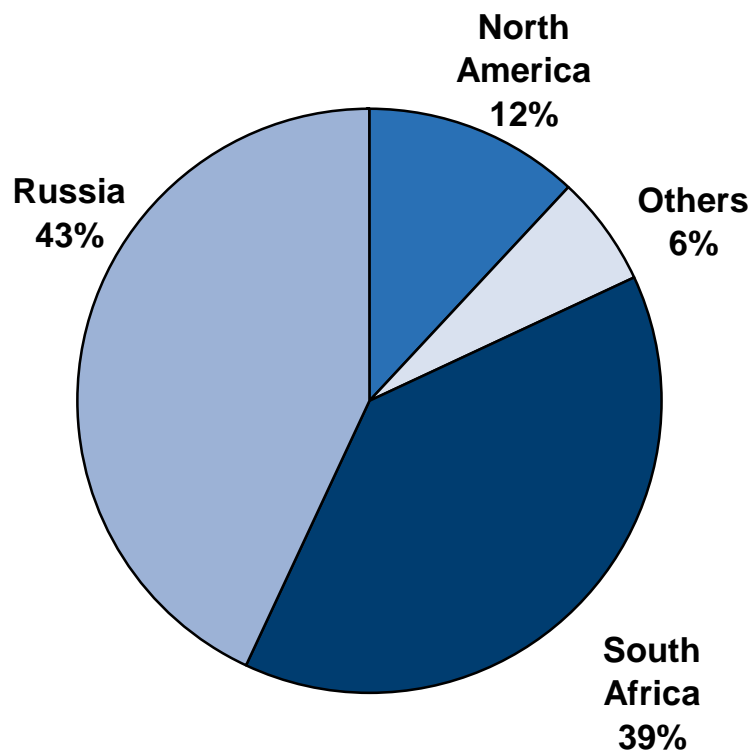
### Political risks

- The 2009 world production of platinum is estimated to be 178 tons
- The recycling of scrap mainly from automobile catalysts has an increasing importance
- It is necessary to reduce the jewelry consumption of platinum in the future
- The reserve base for all platinum group metals is estimated with 48,000 tons
- The concentration of the reserves in South Africa could become a political risk

# Palladium 2008

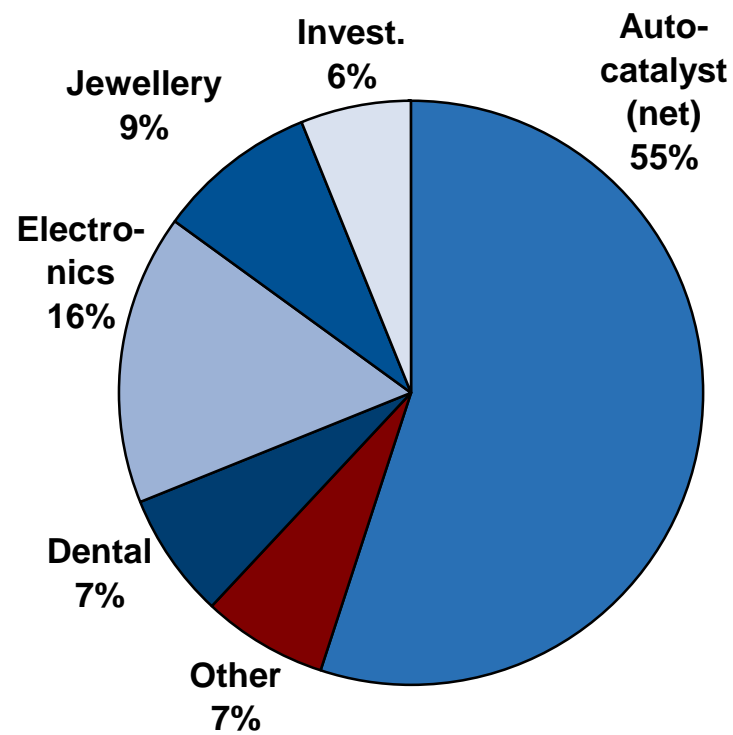
## Supply by region

Total: 7.51 million oz.



## Demand by application

Total: 7.19 million oz.



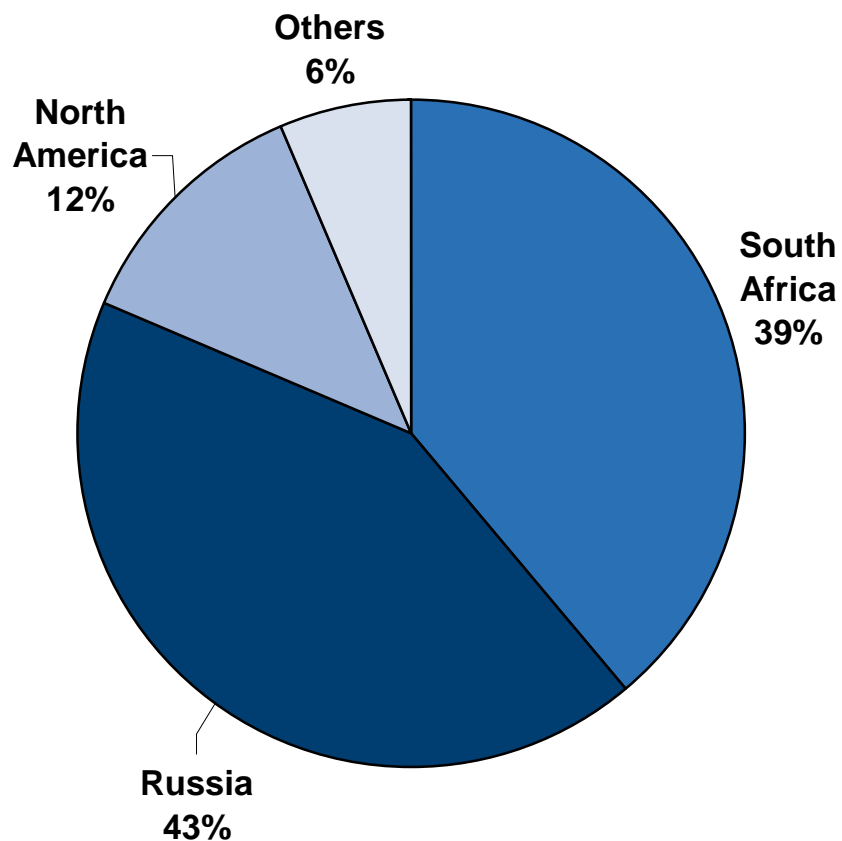
Sources: IPA, IKB estimation

## Palladium: reserves mainly in two countries

17

### 2008 estimated reserve base

in %



Source: U.S. Geological Survey, Mineral Commodity Summaries

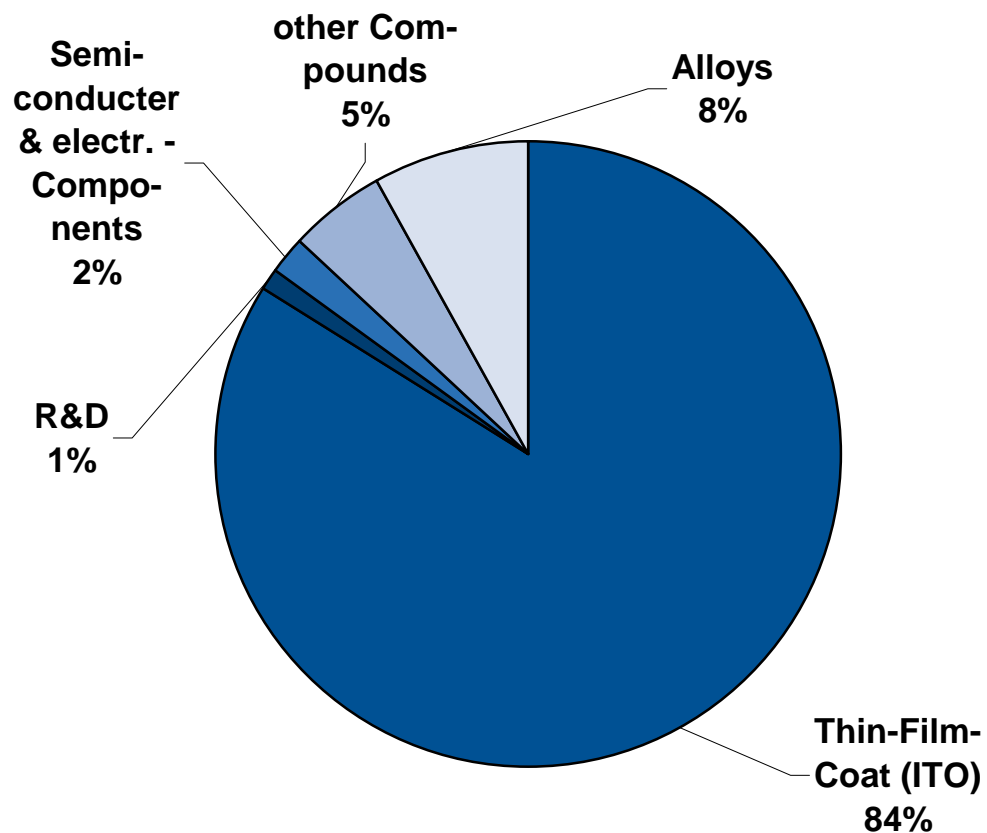
### Another ten years

- The world production of palladium in 2009 is estimated to be 195 tons
- Total production of all platinum group metals (including rhodium, ruthenium, iridium etc.) is estimated to be 440 tons in 2009
- The reserve base for all platinum group metals is estimated to be 48,000 tons

## Rare metals: indium as an example

18

### Applications of Indium



Sources: heise

### How to solve the problem?

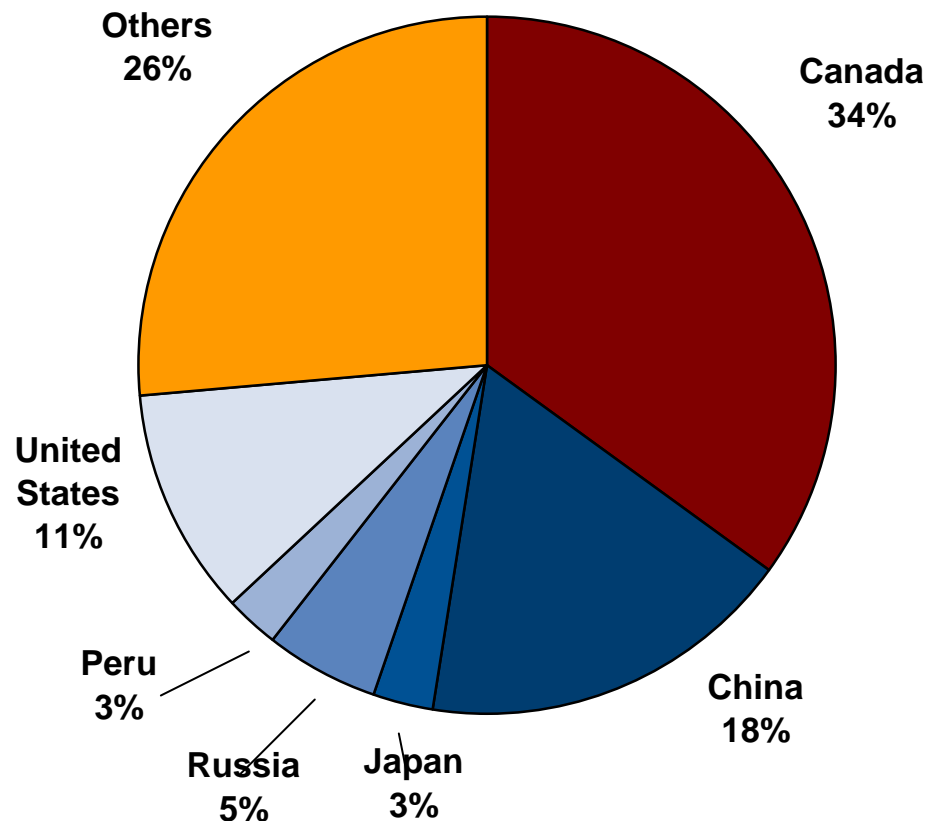
- Indium is a good example for rare metals with a very limited reserve base
- It is essential in a lot of applications in modern electronic devices
- Even the new German reserves are very limited

## Indium: very limited reserve base

19

2009

in %



Source: U.S. Geological Survey, Mineral Commodity Summaries

### Only poor reserves

- Indium is mainly used in flat-panels, touch screens for mobile communication and in photovoltaic applications.
- Total reserves are estimated to be only 5,700 tons (proved 2002).
- Newer estimations expect a reserve base of around 11,000 tons
- Refinery production in 2008 was 568 tons: therefore the proven reserves last for only 10 years!
- Recycling facilities are currently mainly in China, Japan and the Republic of Korea.
- To fulfill the future demand for Indium, it is necessary to increase recycling capacities is necessary and collect old mobile phones!



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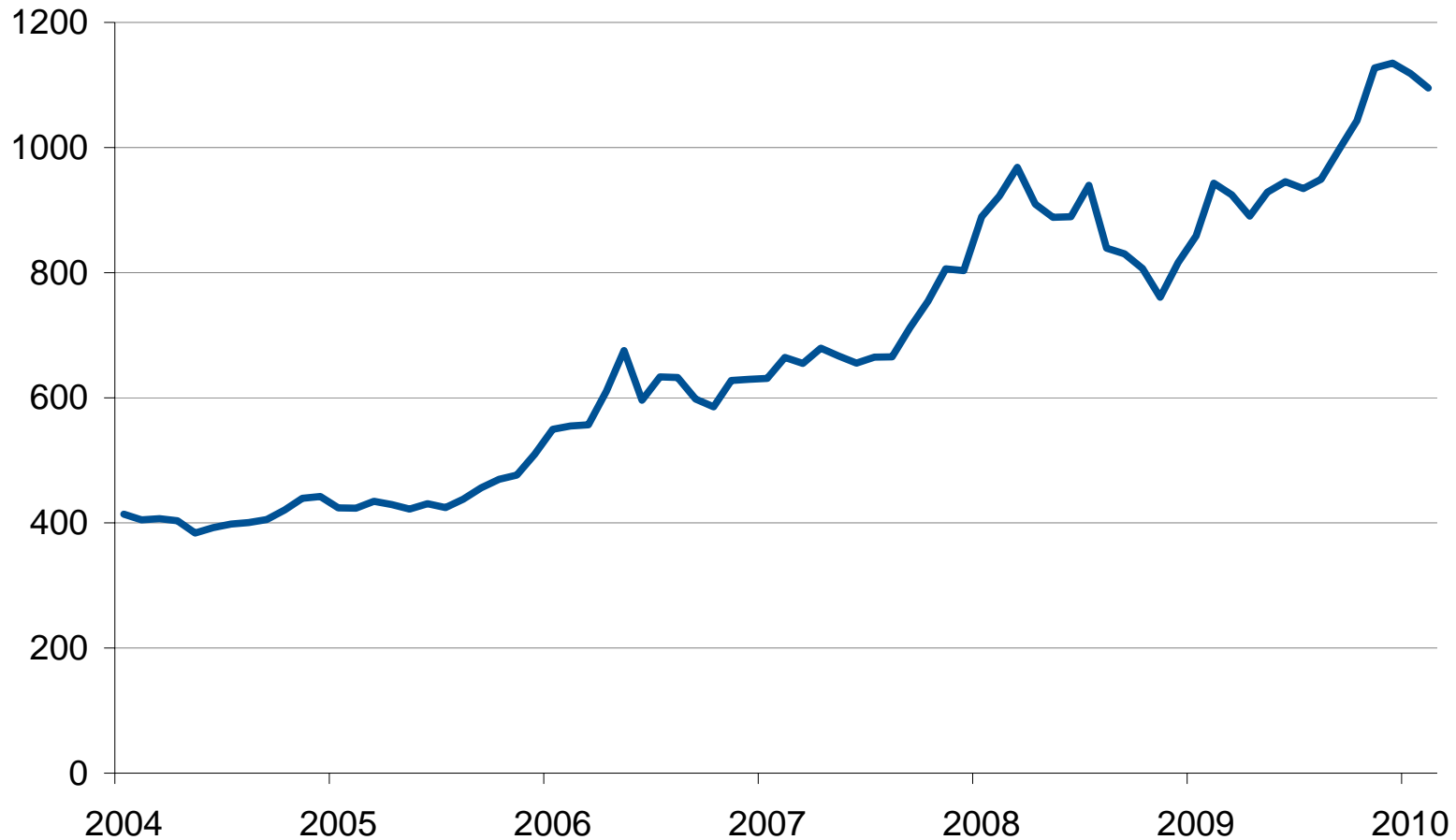
20

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## Gold: near all-time-high

21

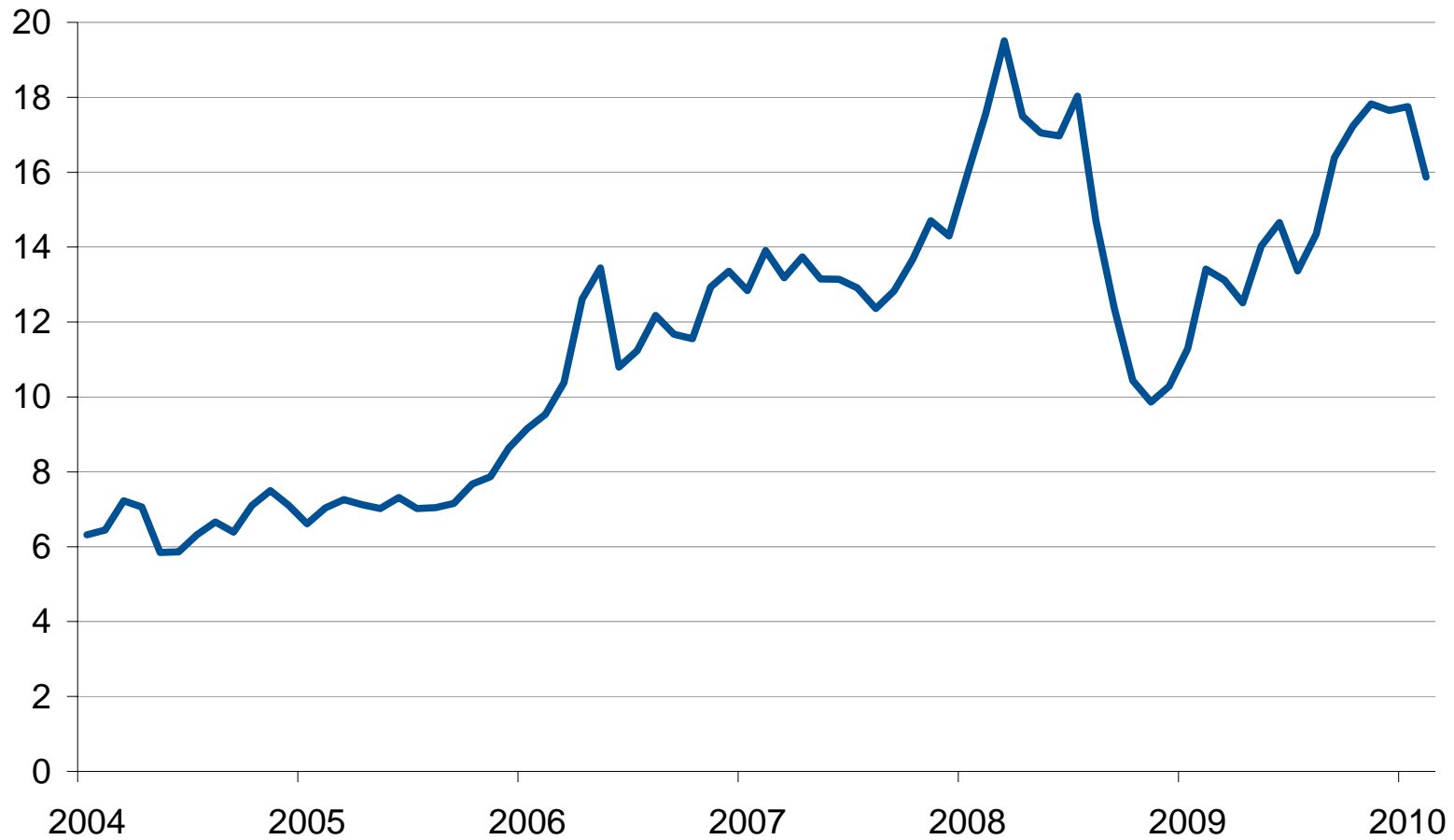
Gold price in U.S. \$ / Troy Ounce



Sources: Global Insights, Platts

## Silver: highly volatile

Silver price in U.S. \$ / Troy Ounce

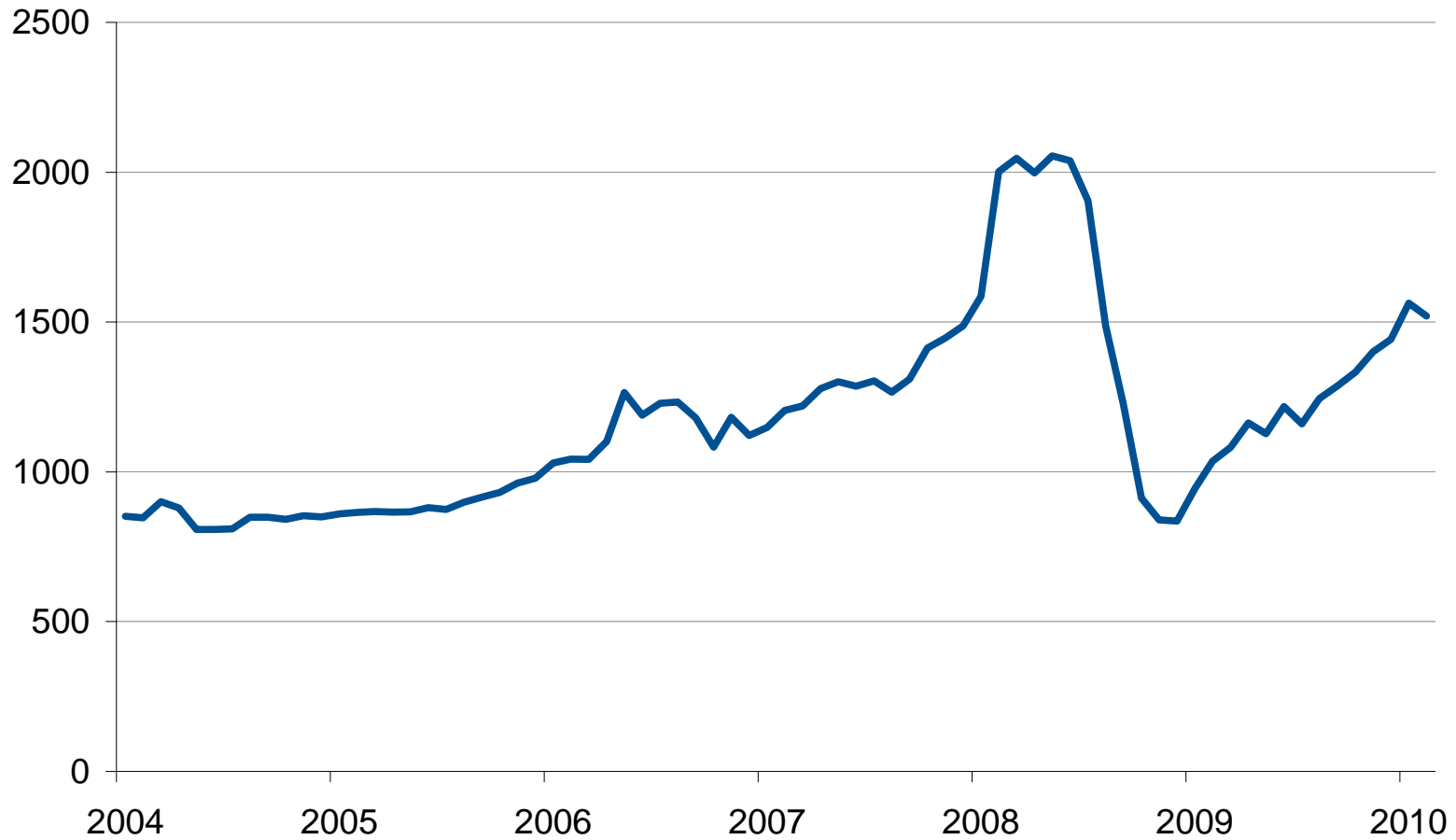


Sources: Global Insights, Platts

## Platinum: risks in South Africa

23

Platinum price in U.S. \$ / Troy Ounce

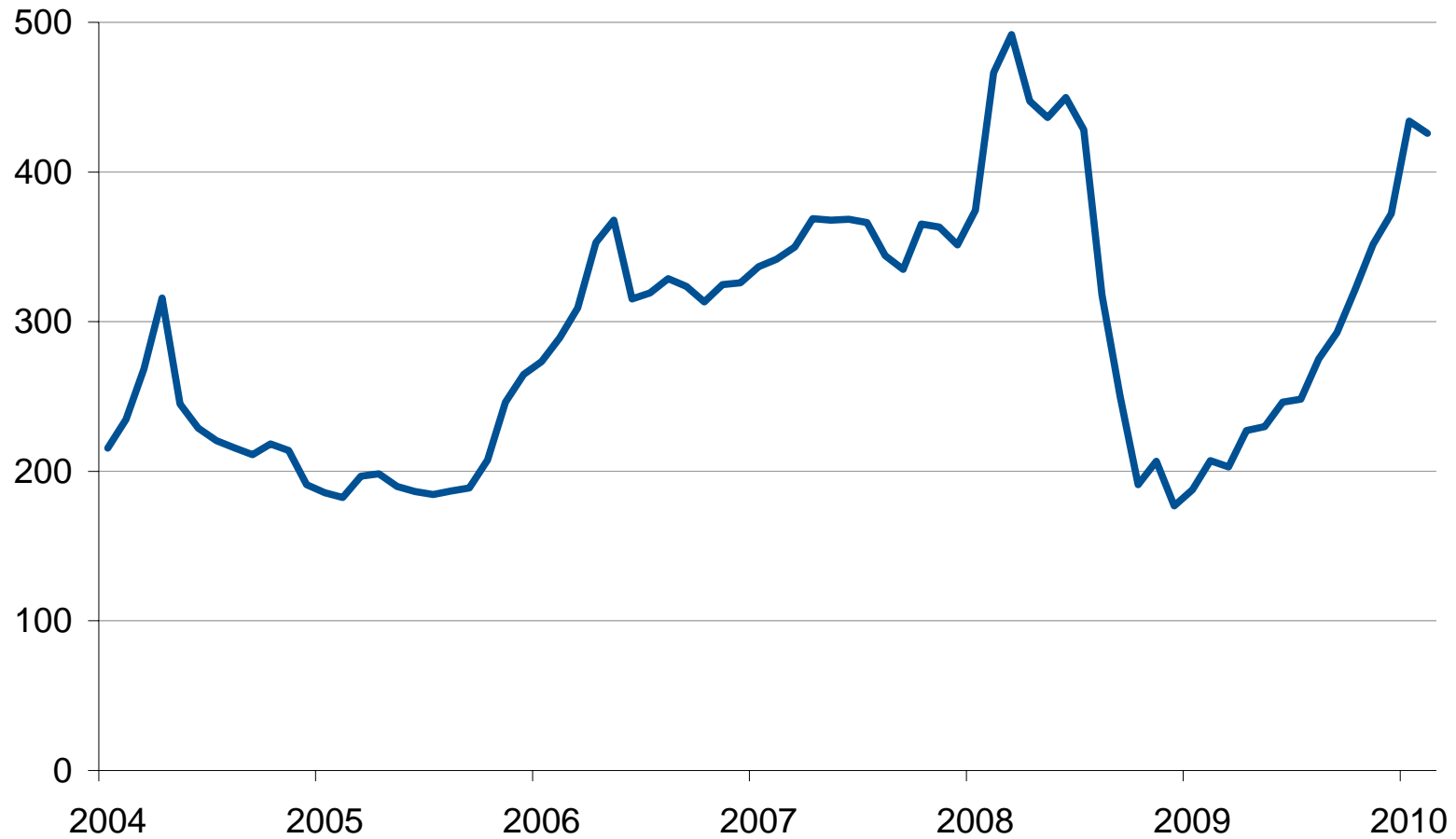


Sources: Global Insights, Platts

## Palladium: quick recovery

24

Palladium price in U.S. \$



Sources: Global Insights, Platts



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