Suomen mineraalistrategian avajaisseminaari.

Esbo 17:e mars 2010.

Global mining towards 2030 !

Copper drawing: Kaianders Sempler.

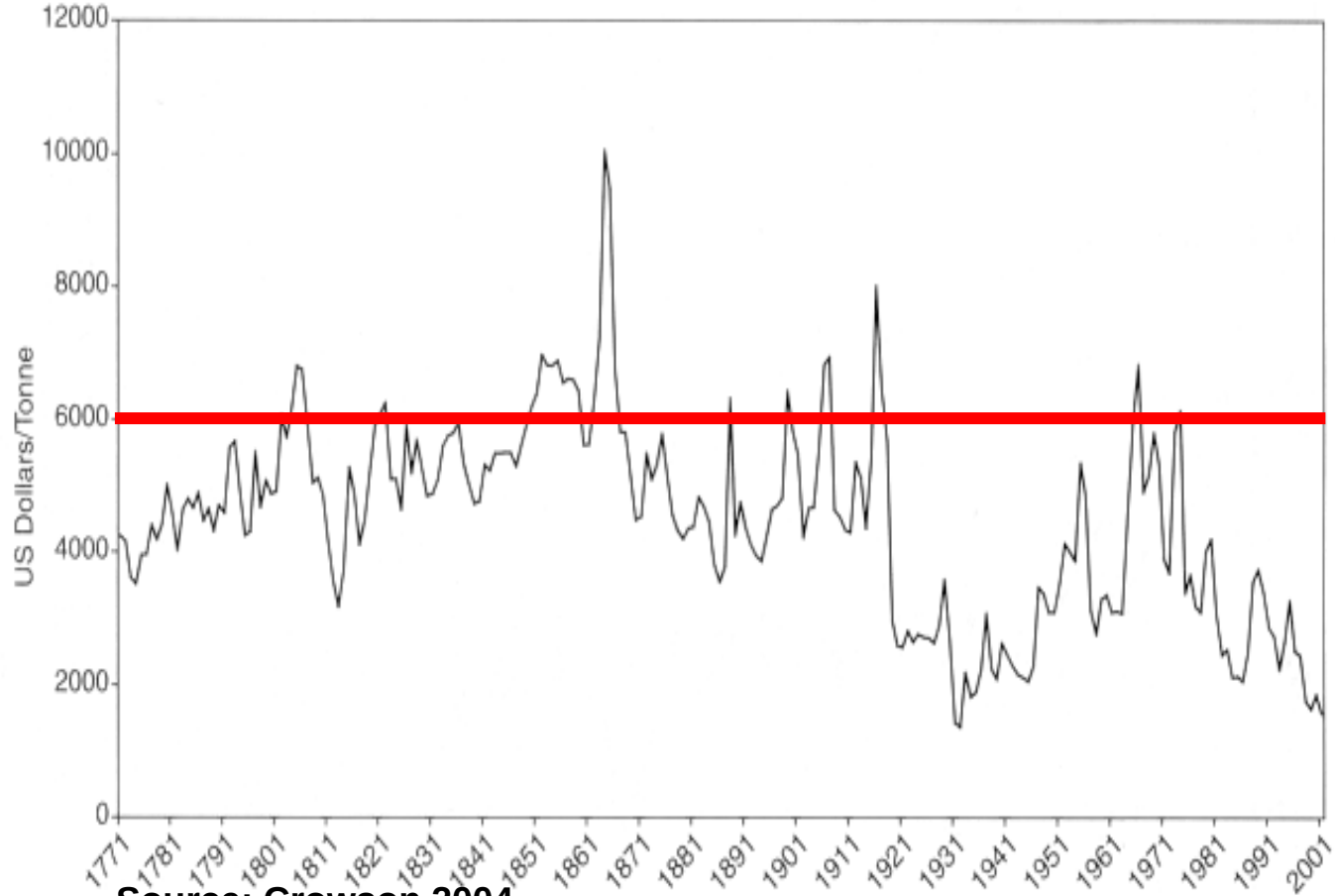
Magnus Ericsson

Raw Materials Group

Mining can be sustainable - Garpenberg mine since 13th c.

Courtesy: Boliden.

Copper price in real terms 1771 - 2001

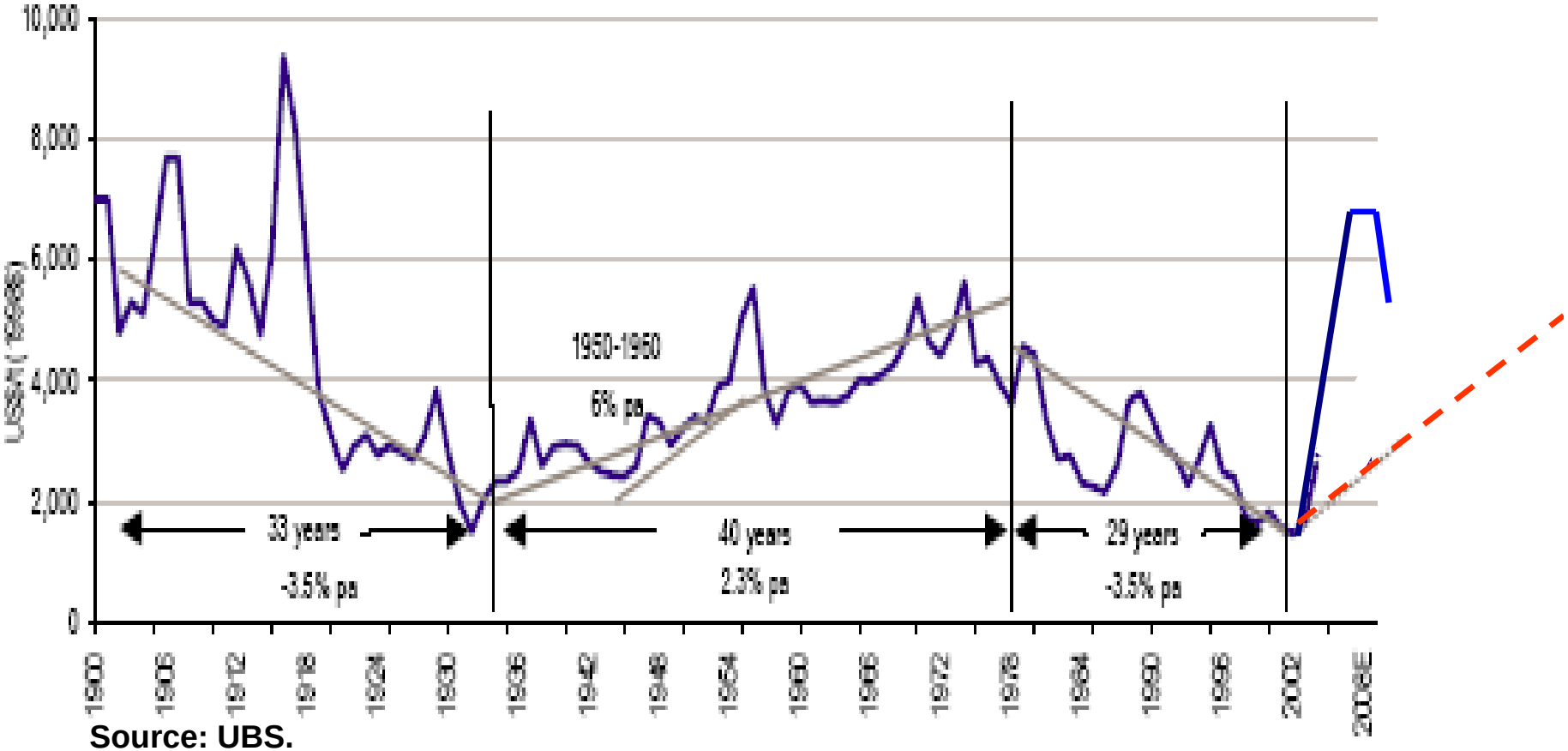


6000 USD/t

Source: Crowson 2004.

Raw Materials Group

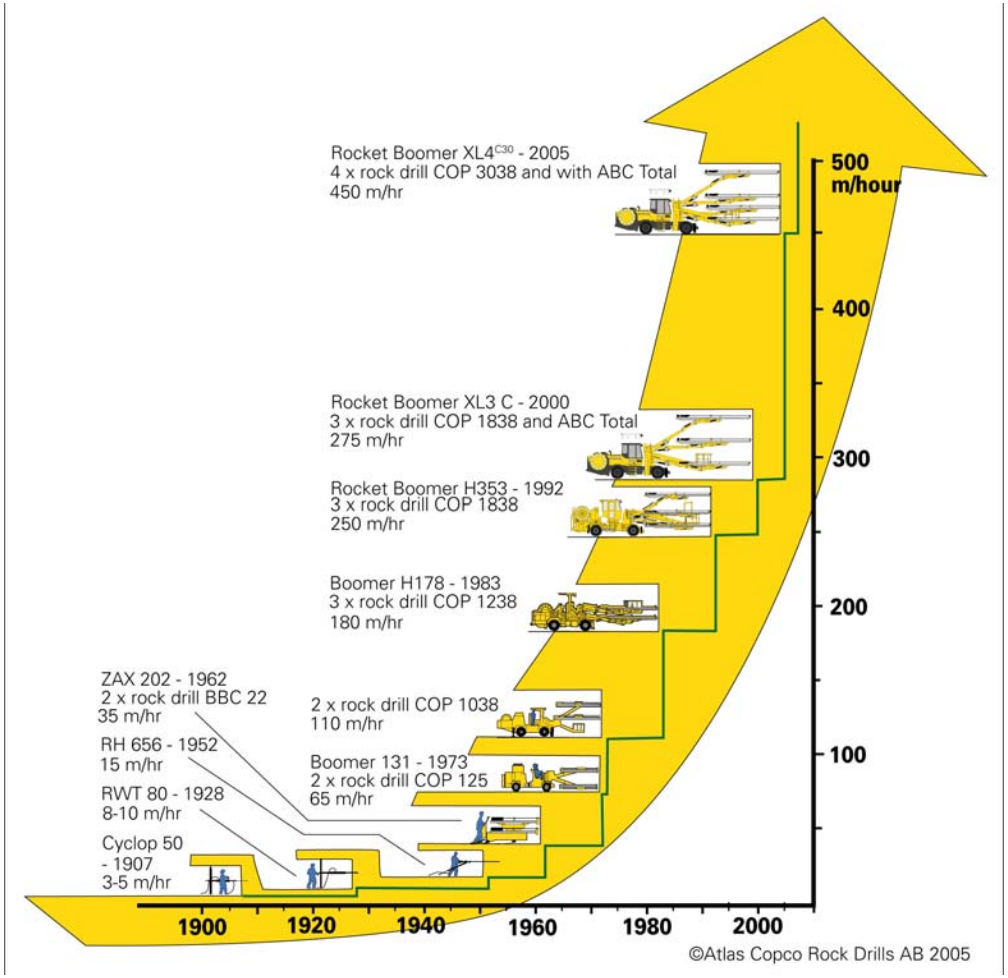
Long term copper price cycles



Source: UBS.

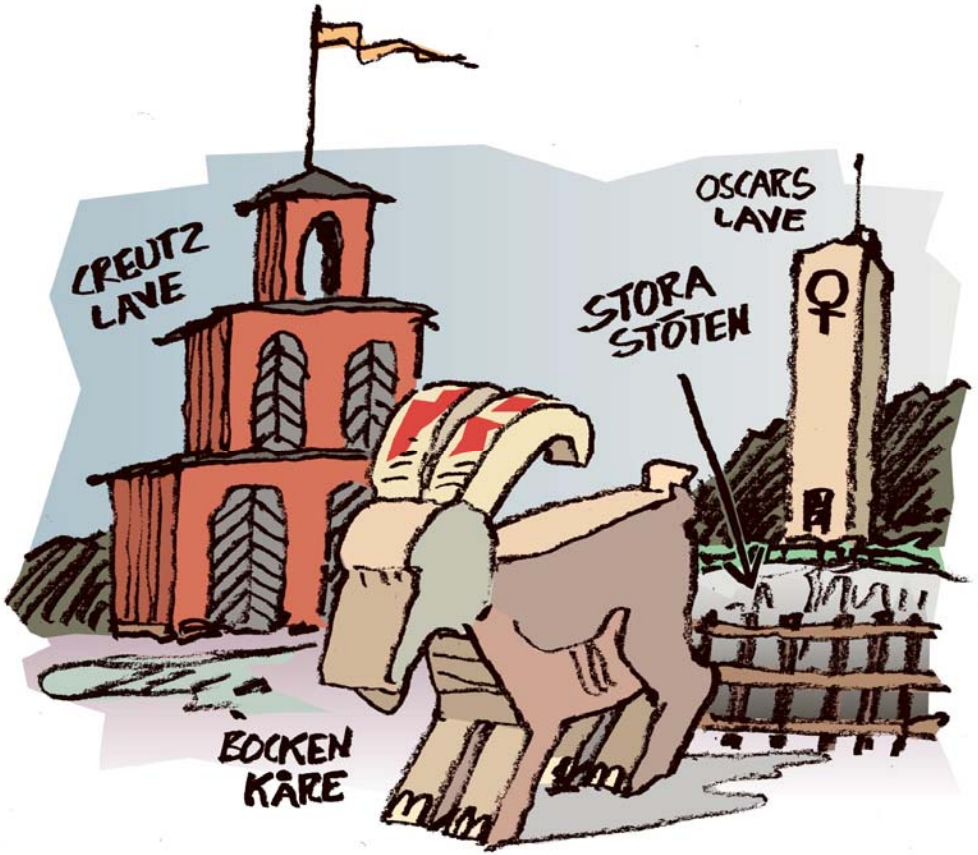
Raw Materials Group

Technical development



Drilling technology during 100 years

Raw Materials Group



Copper drawing: Kaianders Sempler.

Mining is:
International
Long term
Cyclical

Raw Materials Group

Agenda

- Long term trends
- Nordic countries in the world
- Policy implications

Long term trends

Demand

Supply

Vanadium drawing: Kaianders Sempler.

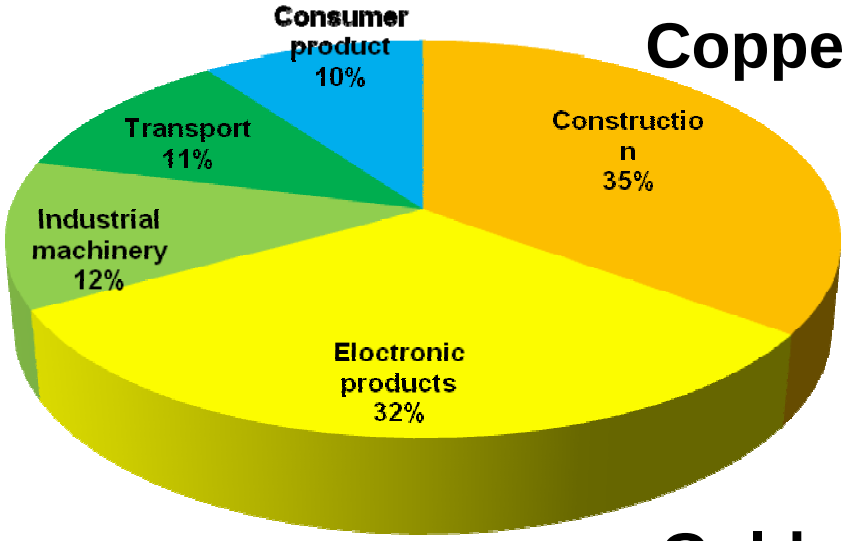
Raw Materials Group

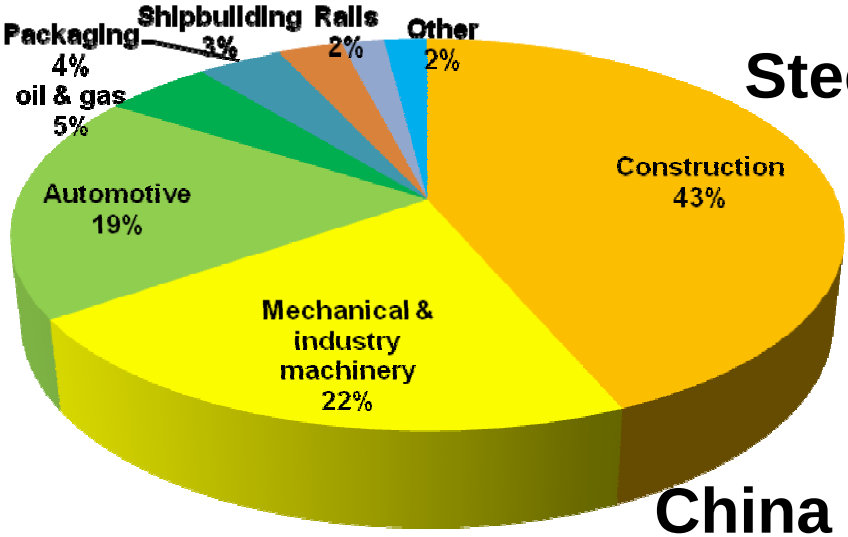
Special properties of metals

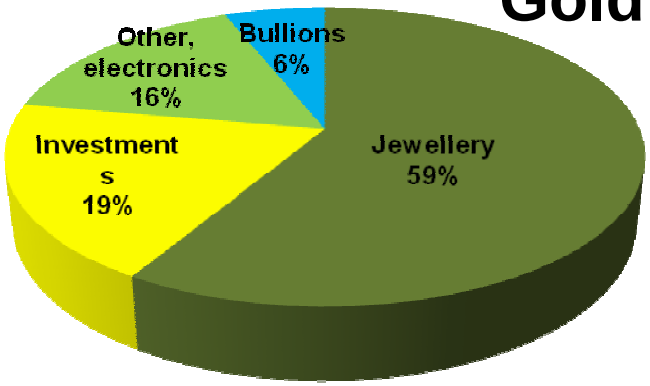
- High strength
- Affordable cost
- Conduct heat and electricity
- Beautiful
- Undestructable

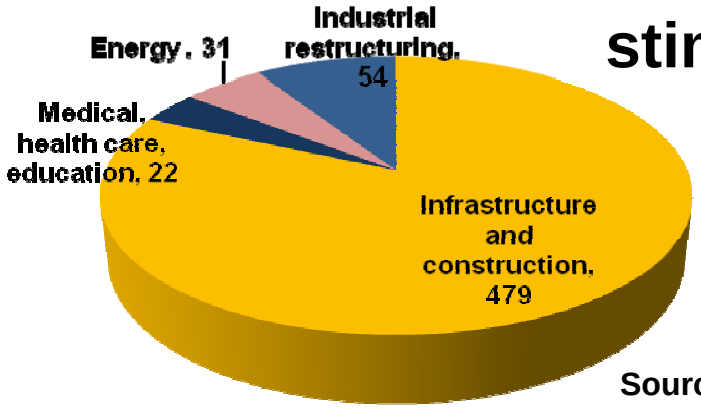
Source: T. Graedel, Yale University.

Metal end use







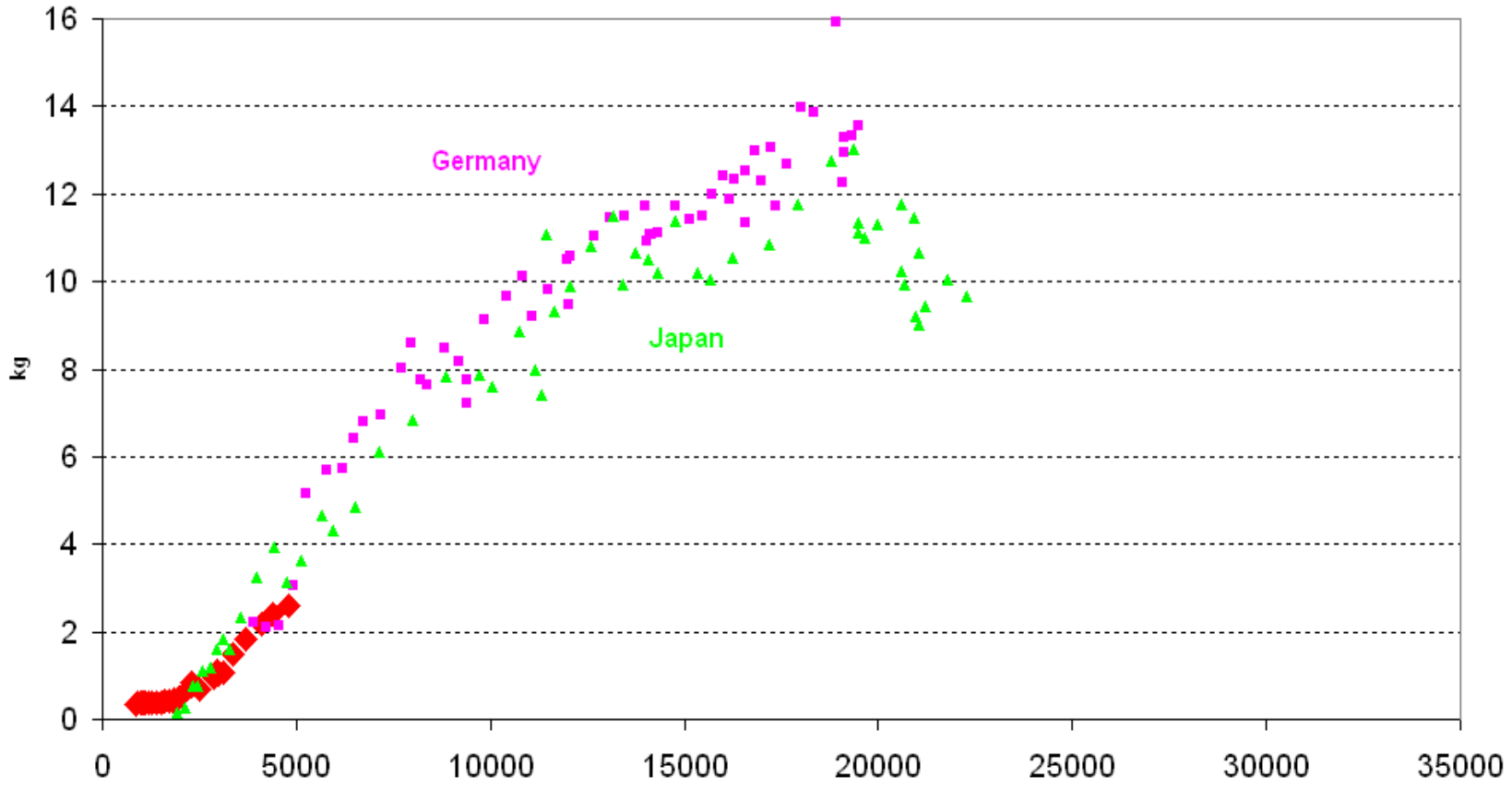


Source: Raw Materials Group, Stockholm 2009.

Source: NDRC

Raw Materials Group

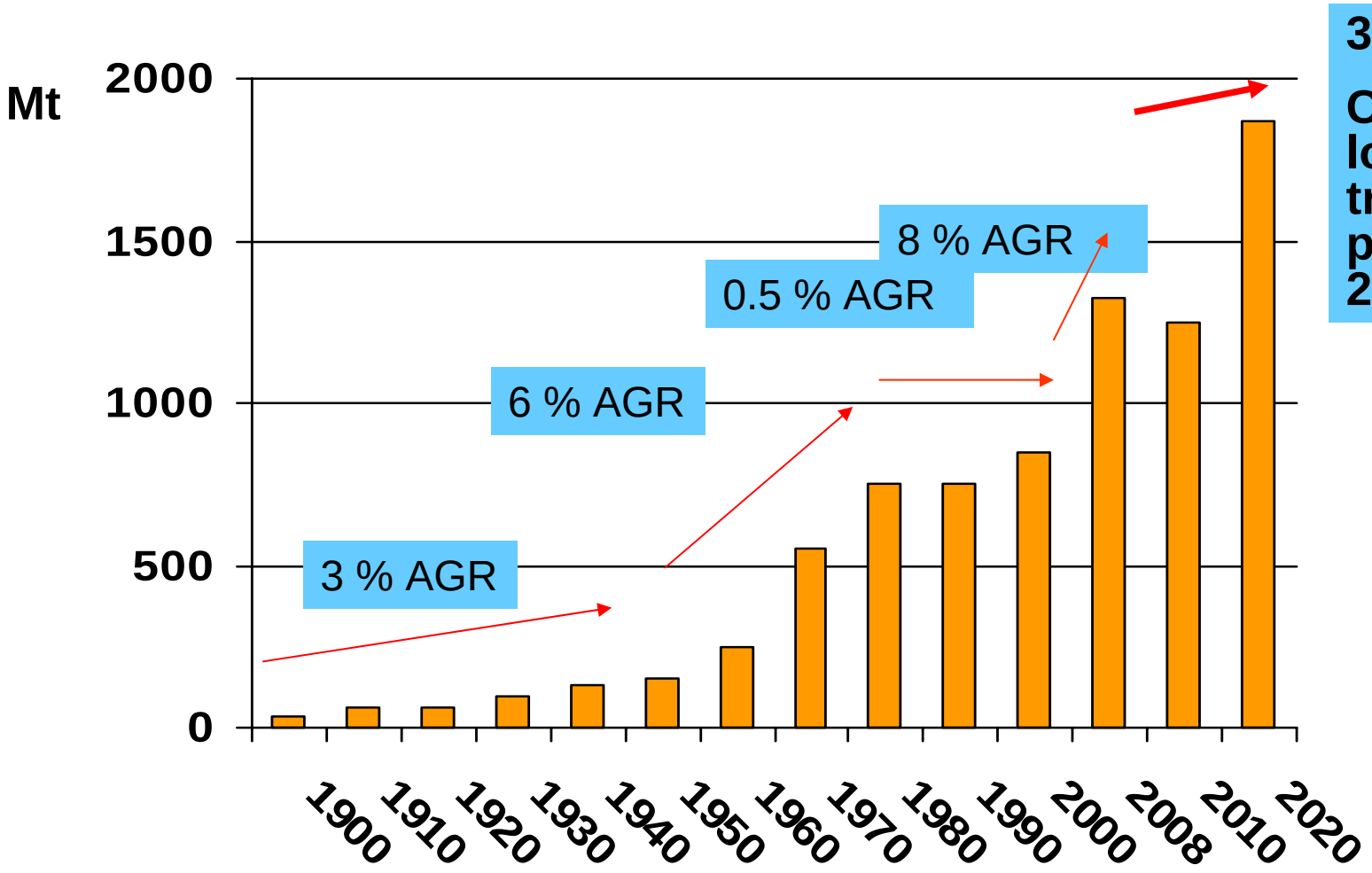
Copper use vs GDP/capita



Source: Häggström, Handelsbanken 2006.

Raw Materials Group

Global steel production



3.3 % AGR

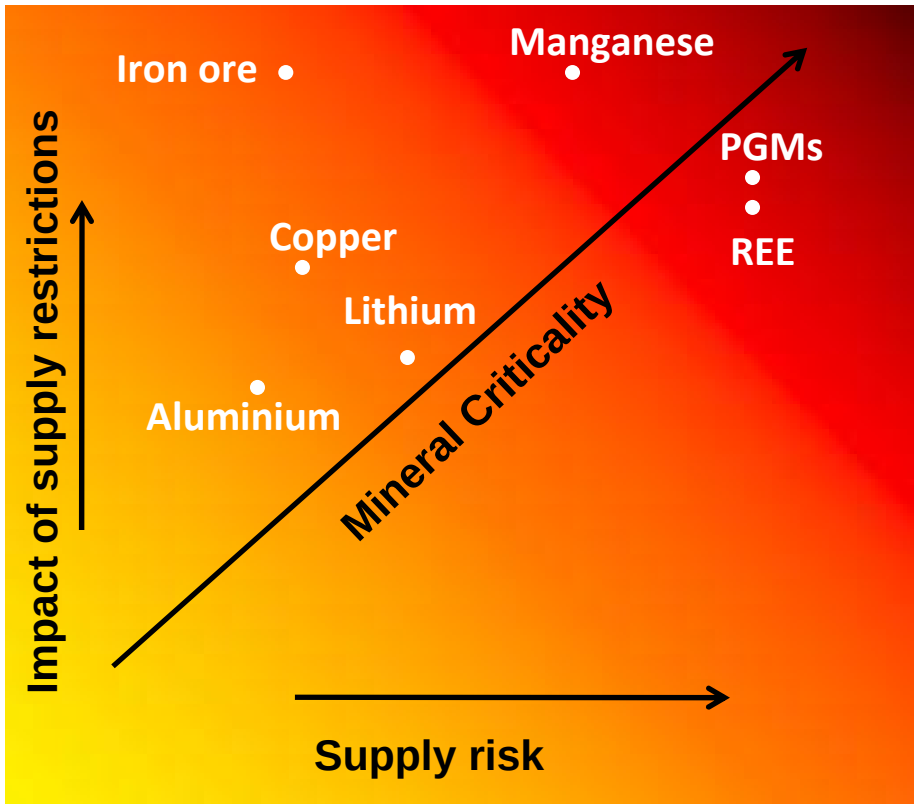
Conservative long term trend projected to 2020

Source: IISI/WSA, RMG projections.

Raw Materials Group

Mineral criticality

Supply restrictions:
- **Price elasticity**
- **Substitution**
- **R&D**



Reliability of Supply:
- **Geological**
- **Technical**
- **Environmental & Social**
- **Political**
- **Economical**

Source: Eggert 2007

Vanadium drawing: Kaianders Sempler.

Demand summary

- Metals cannot be replaced.
- Extended period of growth.
- China/Asia major engines.
- Infrastructure & personal use.
- Decline less dramatic than expected – long term growth will slow down but remain steady.
- New strategic metals.

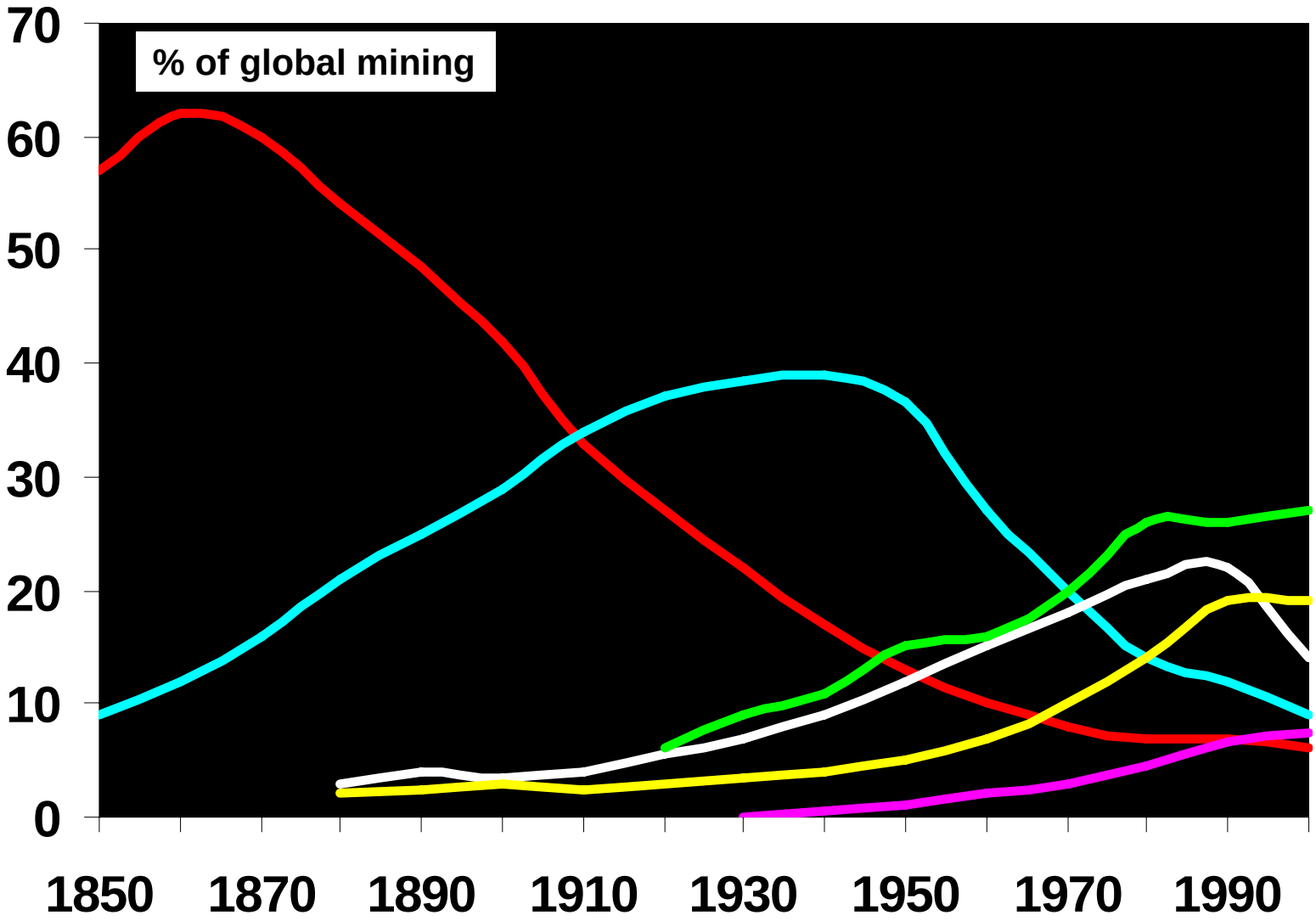
Raw Materials Group

Supply

REM drawing: Kaianders Sempler.

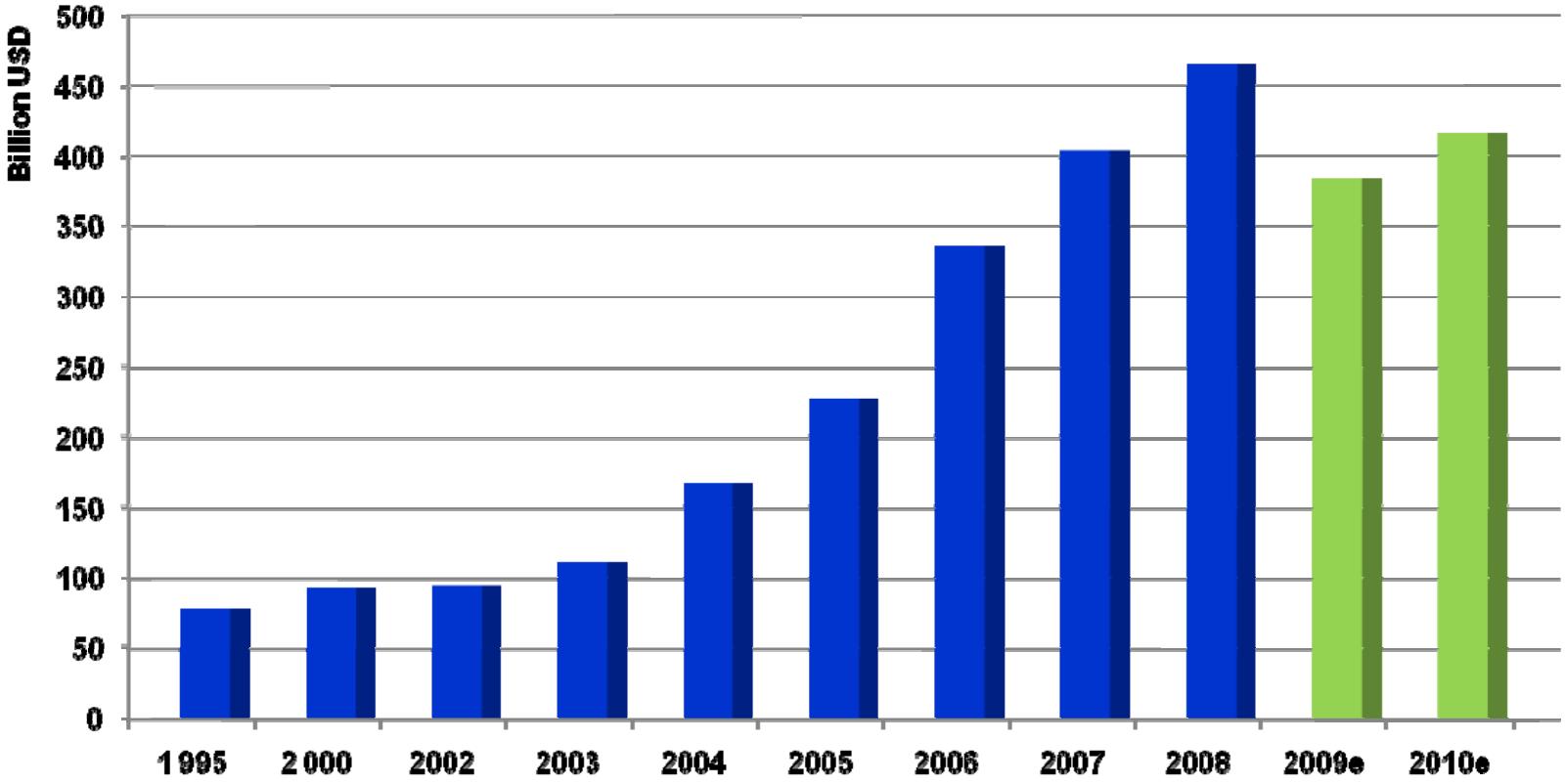
Raw Materials Group

Global mining – 19th/20th century



Value of global mining

Value of metals, diamonds and uranium

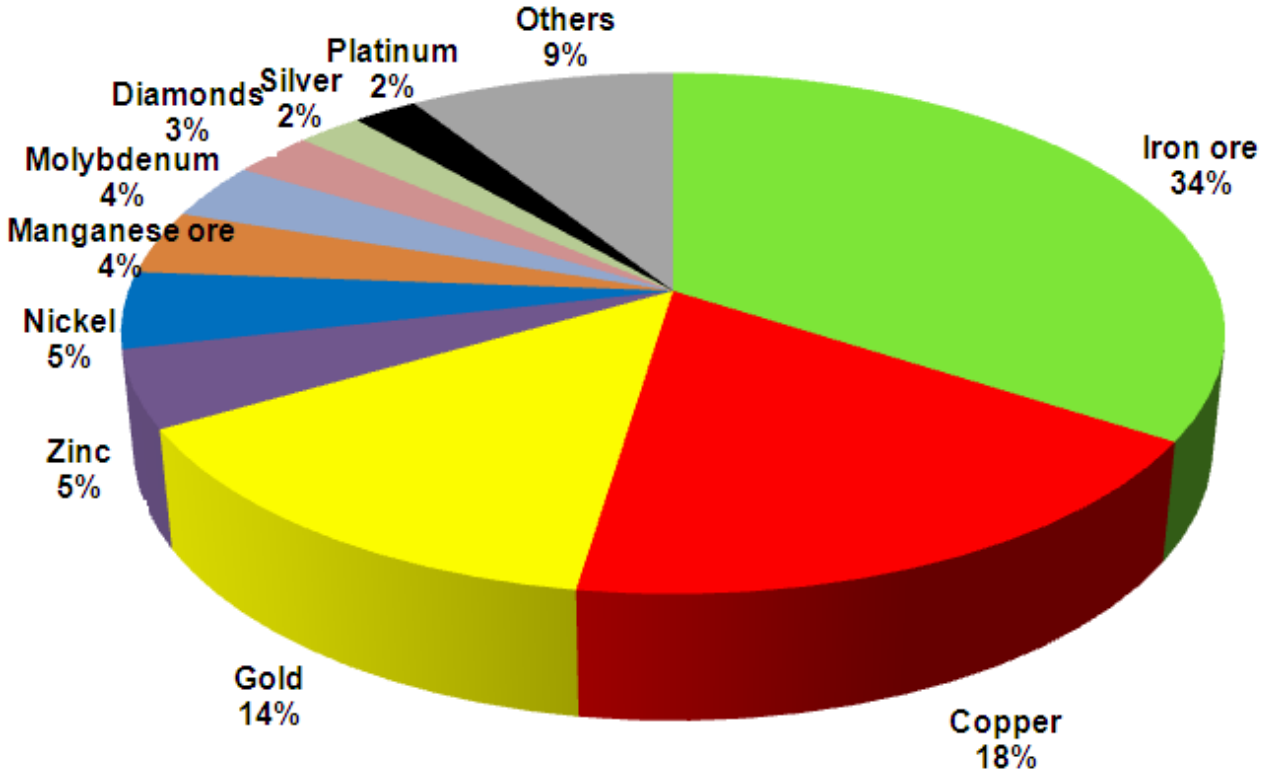


Source: Raw Materials Group, Stockholm 2009

Raw Materials Group

Metals value at mine

2008 total ~ 463 billion USD, metals, diamonds and uranium



Source: Raw Materials Group, Stockholm 2009

Raw Materials Group

Corporate concentration increasing

FINANCIAL TIMES FRIDAY MARCH 12 2010

Markets

Vale turns up heat on iron ore price

European steel industry 'outraged'

By Javier Blas in London

Vale of Brazil, the largest iron ore miner, has asked some of the world's top steel producers to pay 80-100 per cent more for their ore supplies in 2010-11, according to the association of the European steelmakers.

Eurofer's statement is the first confirmation that iron ore miners, including Vale, Rio Tinto and BHP Billiton, are seeking a record price increase for iron ore supplies.

Gordon Moffat, Eurofer director general, told the Financial Times that Vale had proposed an 80-90 per cent increase in the cost of lower quality ore fines to European steelmakers and a more than 100 per cent increase in the price of higher quality ore lumps and pellets. "Rio Tinto and BHP Billiton are so far sitting on the sidelines," he said.

In a statement, Eurofer said: "The European steel industry is outraged at the announcement by the iron ore industry to massively increase prices."

Mr Moffat added that Vale wanted to move ore supply deals from annual to quarterly contracts. He declined to name the steelmakers that have received the offers, but ArcelorMittal and ThyssenKrupp are the two key members of Eurofer and traditionally have led the negotiations between European mills and the miners.

Vale did not respond to calls seeking comment.

The demand for a record price increase in the bulk commodity used in steelmaking comes as iron ore trades near an 18-month high on the spot market. Spot Australian benchmark iron ore – 62 per cent iron content – yesterday rose to $131.60 a tonne, according to swaps cleared at the Singapore Exchange. Excluding freight costs from Australia to China of about $10 a tonne, current spot prices are about double the $60-a-tonne level at which the annual contracts were settled for 2009-10.

Spot prices have surged 120 per cent over the past year as Beijing stepped up international purchases to offset lower domestic production.

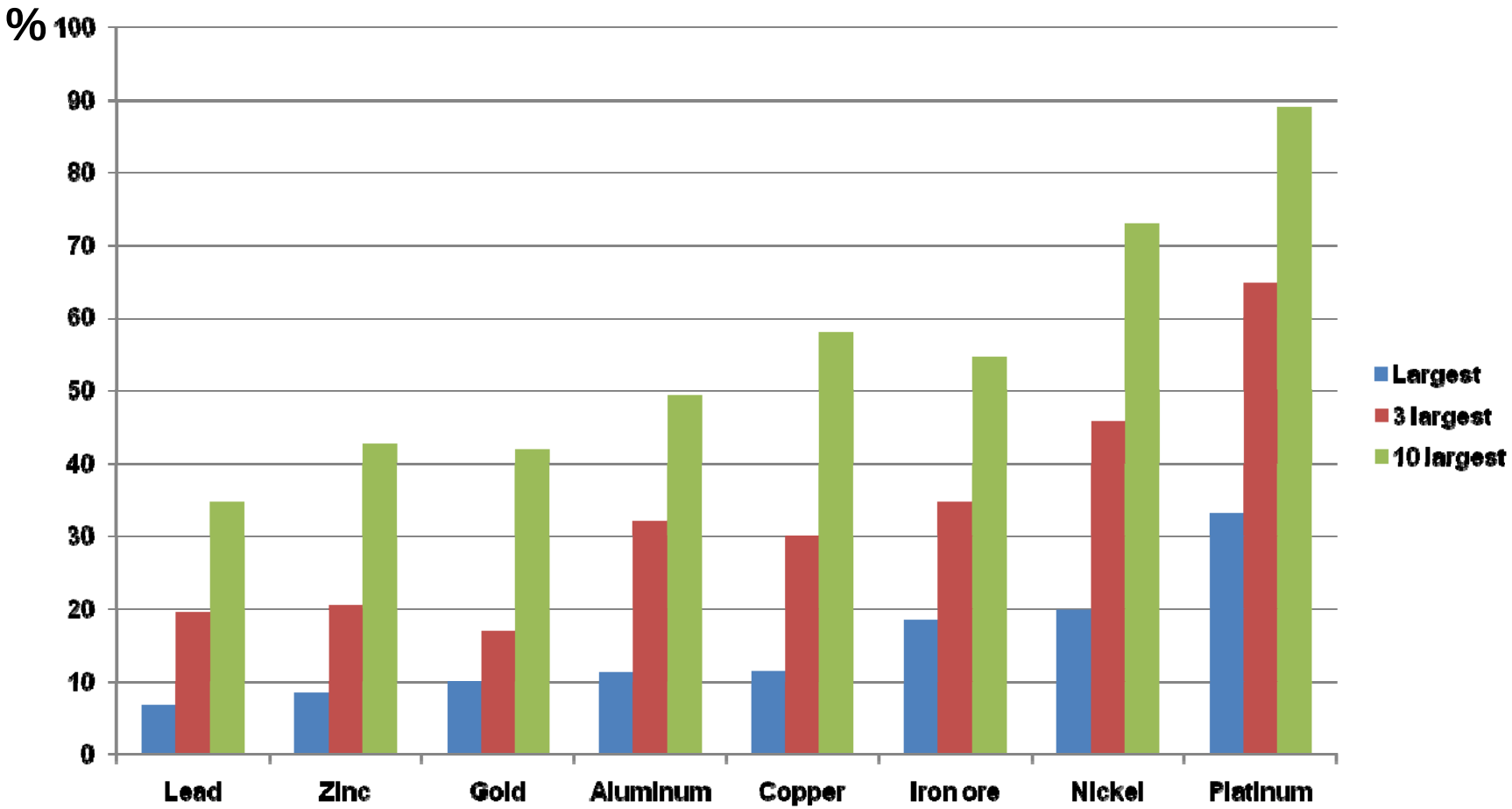
Mining executives have already warned that so-called benchmark annual contracts had to reflect higher spot market prices.

The steelmakers and the miners are running out of time to reach an agreement before the current 2009-11 contracts expire on March 31. Negotiations could continue after the cut-off date, with prices adjusted retro-actively.

The steelmakers ciously resisting increase, arguing spot market does the iron ore m supply and d ance. Mr Moff increases of t proposed wou nificant im prices", su would raise €100 a ton quotes o tonne for rolled coi

Raw Materials Group

Concentration by metal

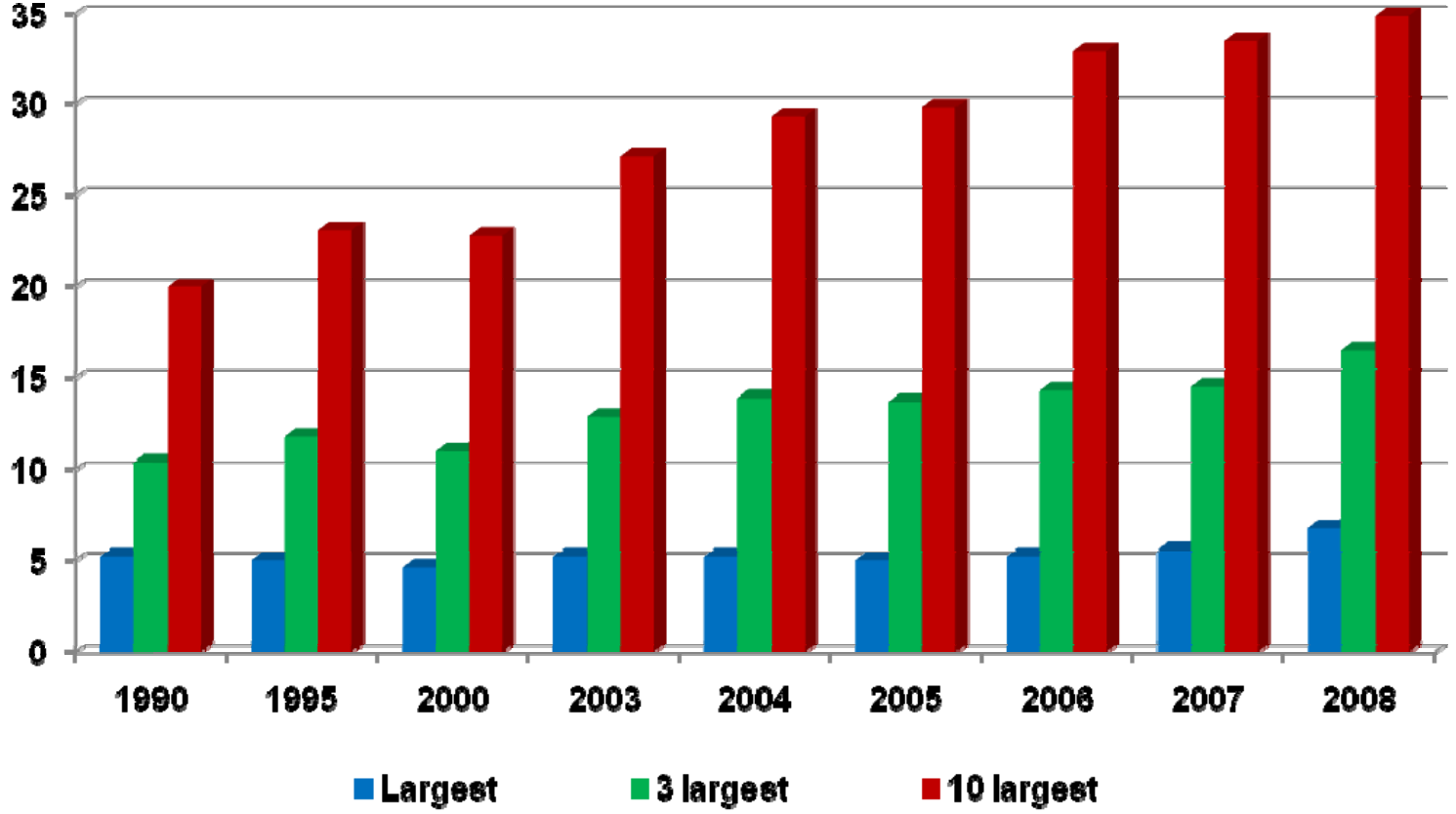


Source: Raw Materials Group 2010.

Raw Materials Group

Corporate concentration

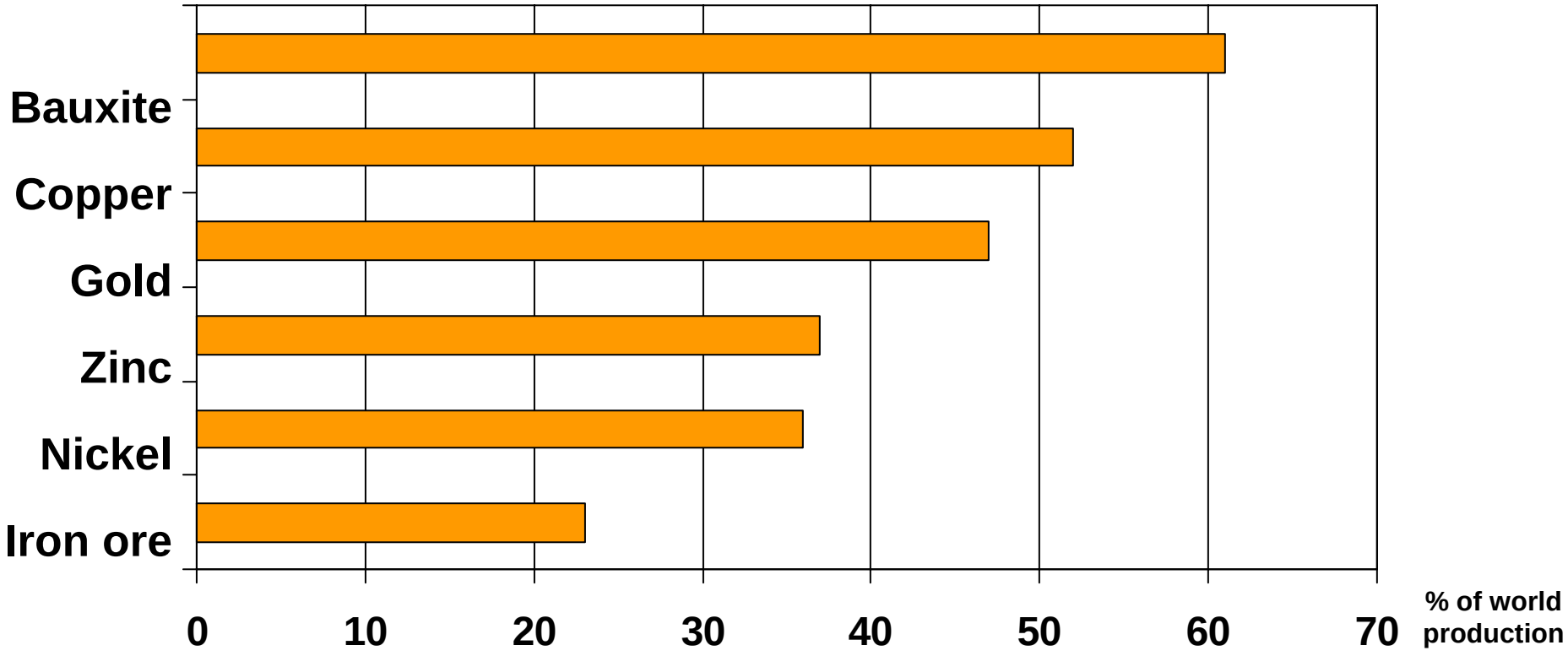
% of total value of non-fuel metal production at the mine stage



Source: Raw Materials Group, 2009.

Raw Materials Group

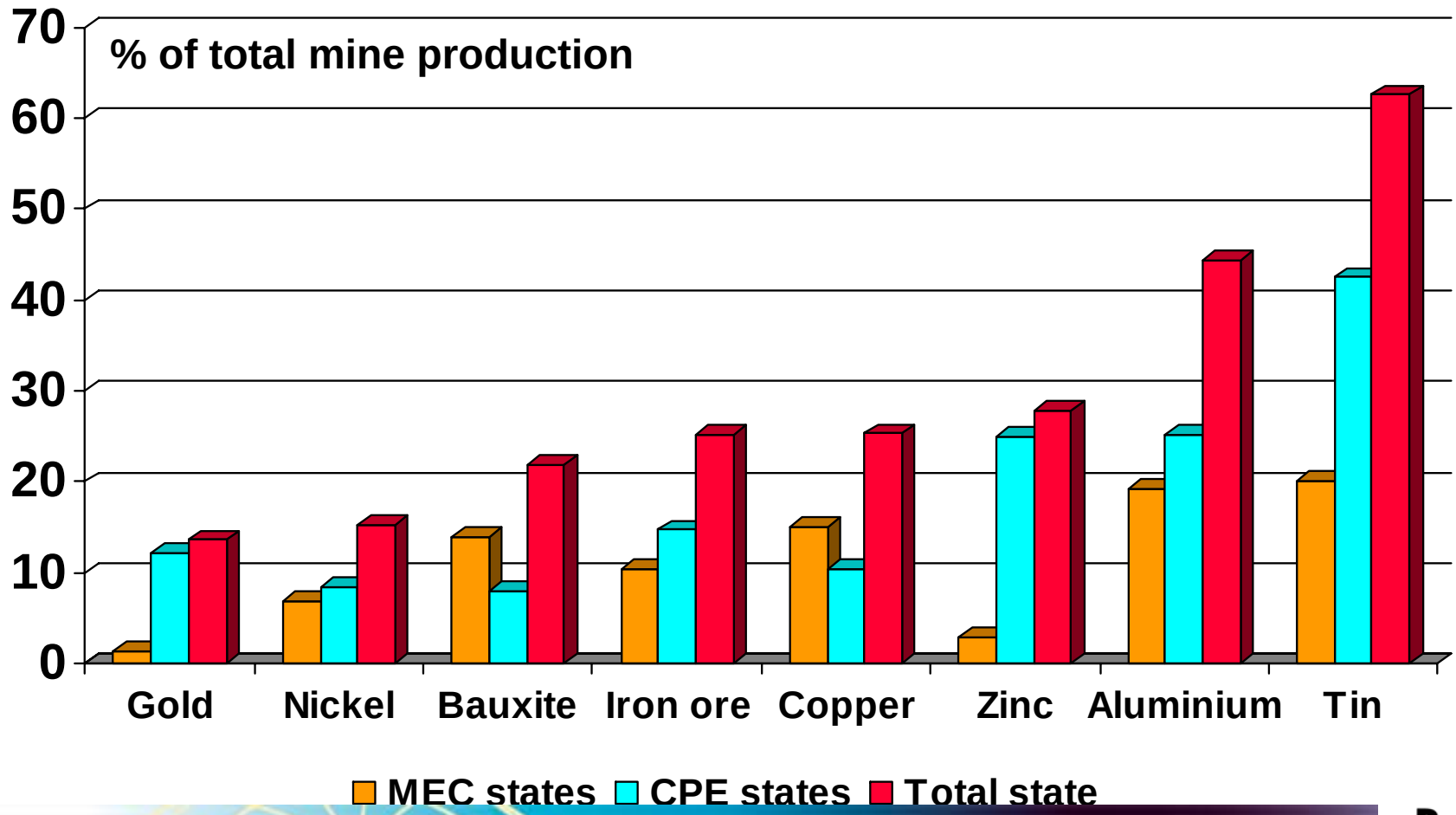
Production by foreign companies



Sources: UNCTAD, based on Raw Materials Data, 2007.

Raw Materials Group

State mining

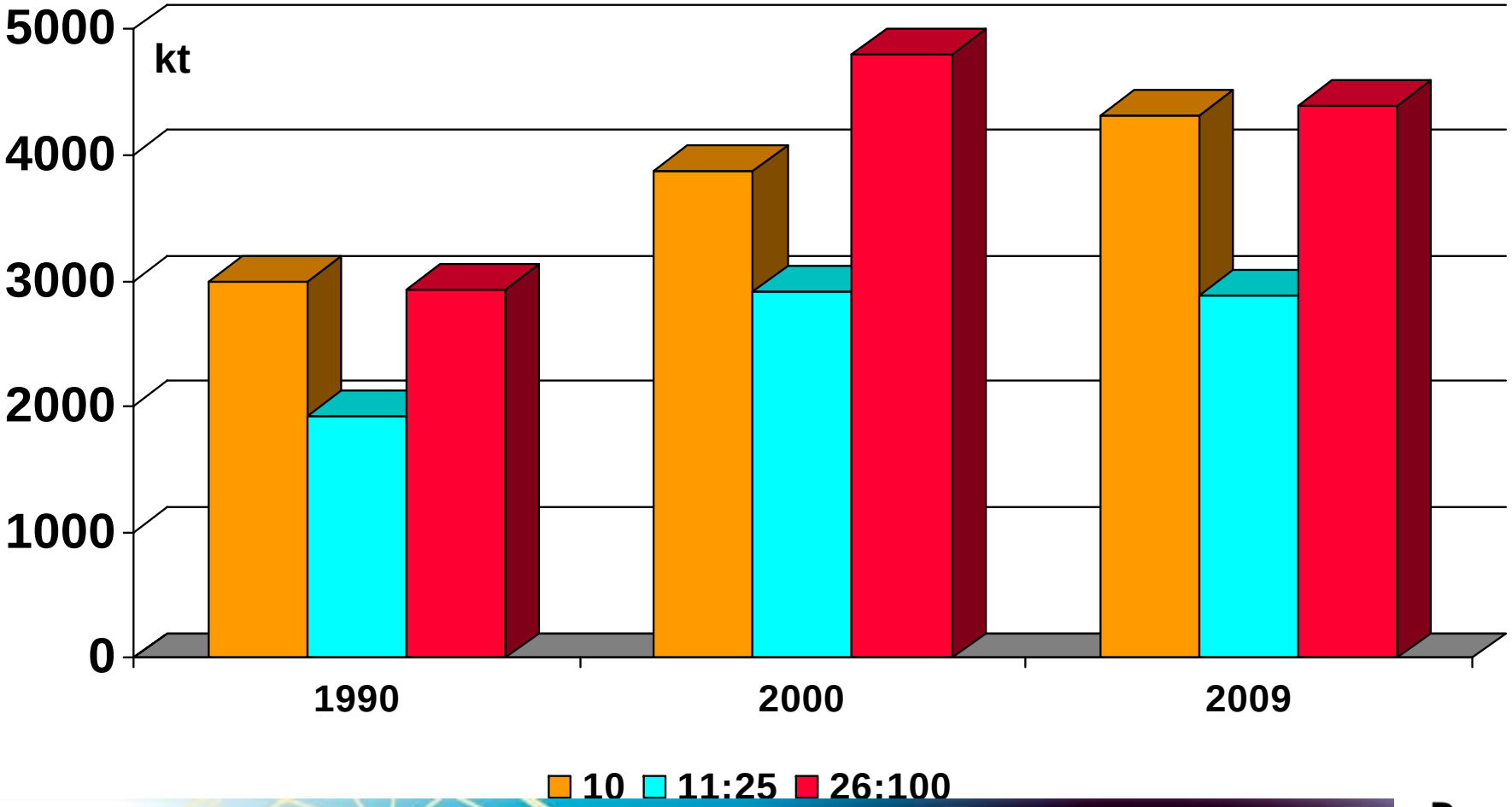


Source: Raw Materials Group, Stockholm.

Note: Aluminium refers to refinery production.

Raw Materials Group

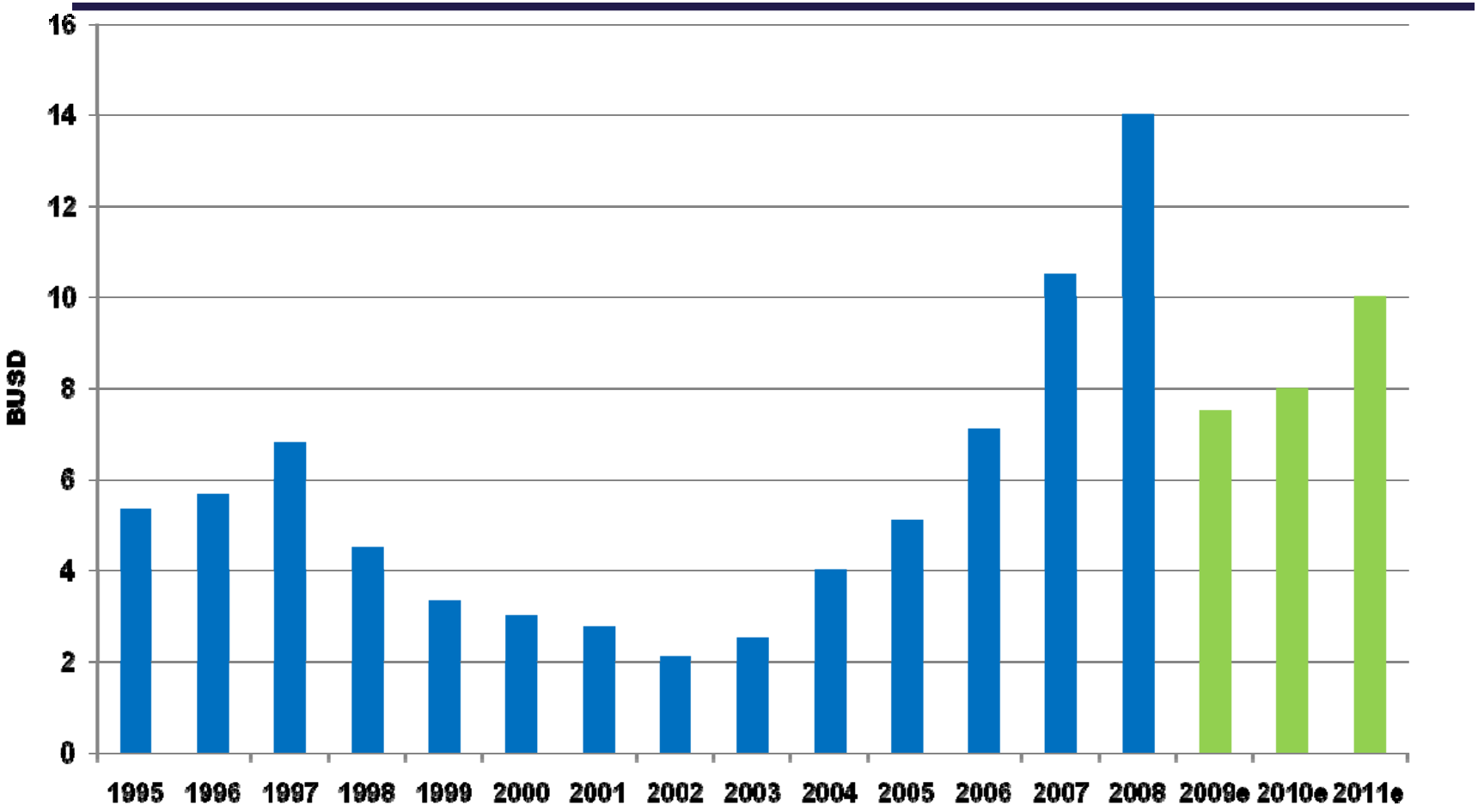
Copper mines get bigger



Source: Raw Materials Group, Stockholm.

Raw Materials Group

Exploration



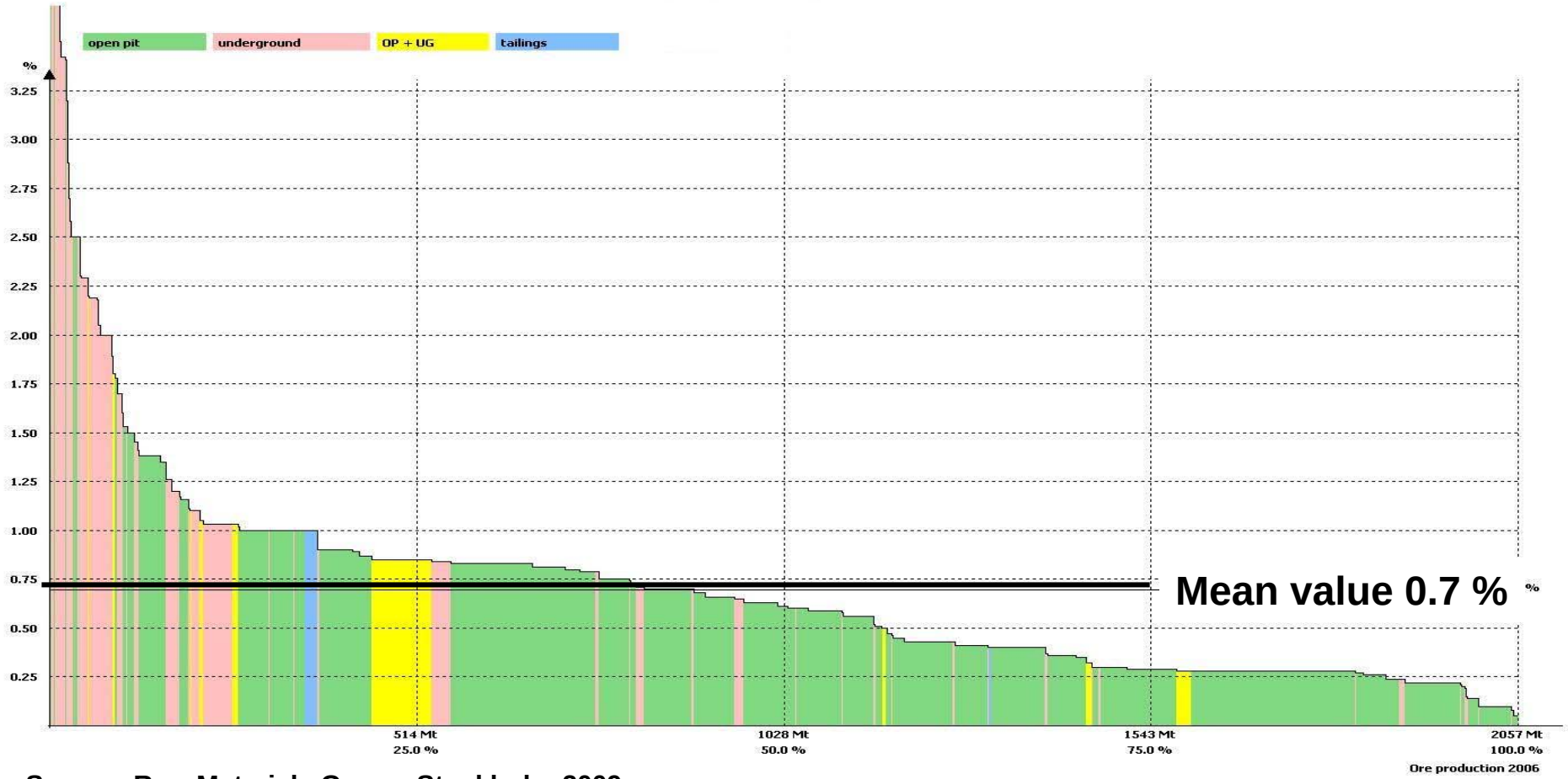
Sources: 1995-2008 MEG, 2009-2011 RMG.

Raw Materials Group

Harsh conditions – remote areas

Raw Materials Group

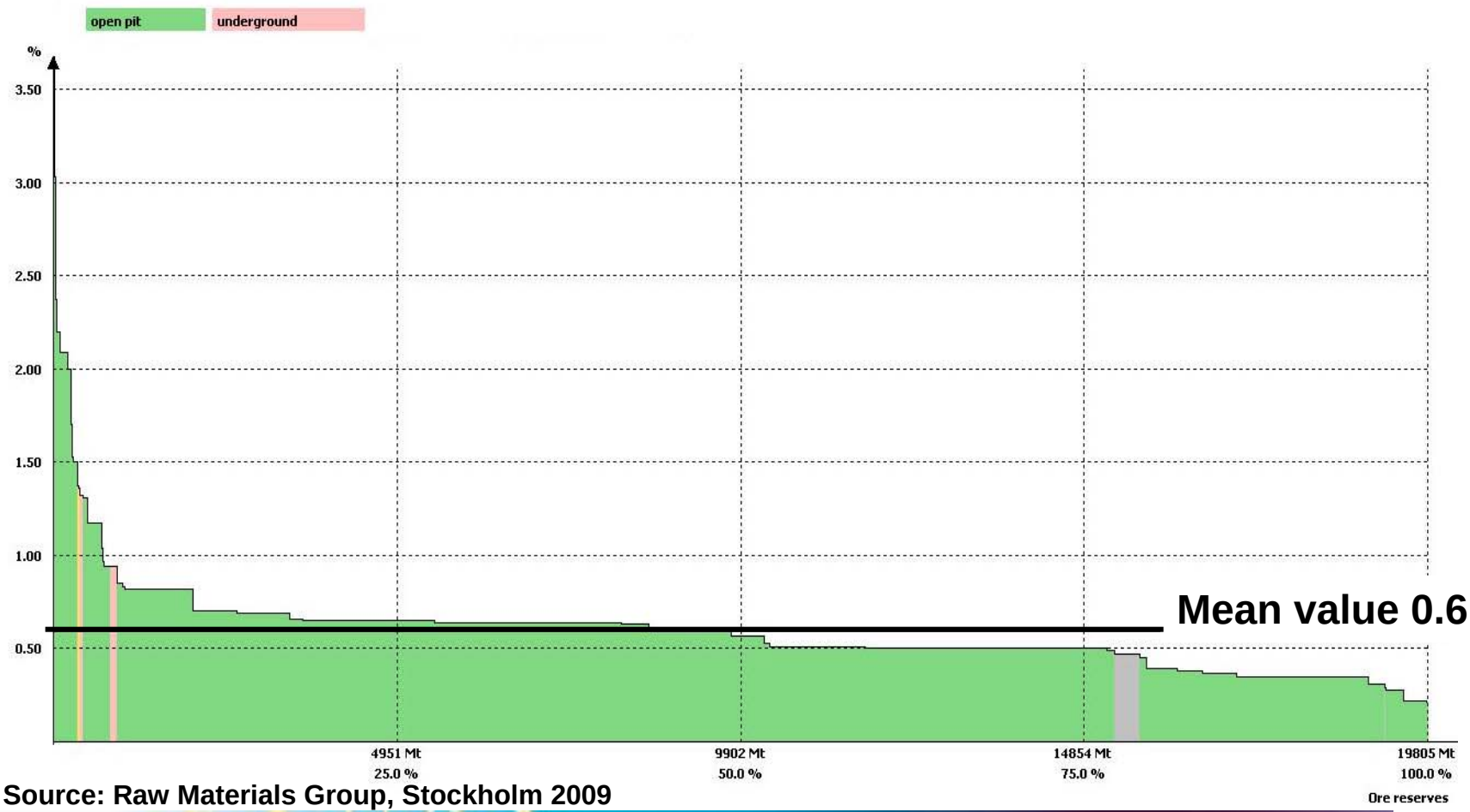
Grades in copper production



Source: Raw Materials Group, Stockholm 2009

Raw Materials Group

Grades in greenfield copper reserves



Source: Raw Materials Group, Stockholm 2009

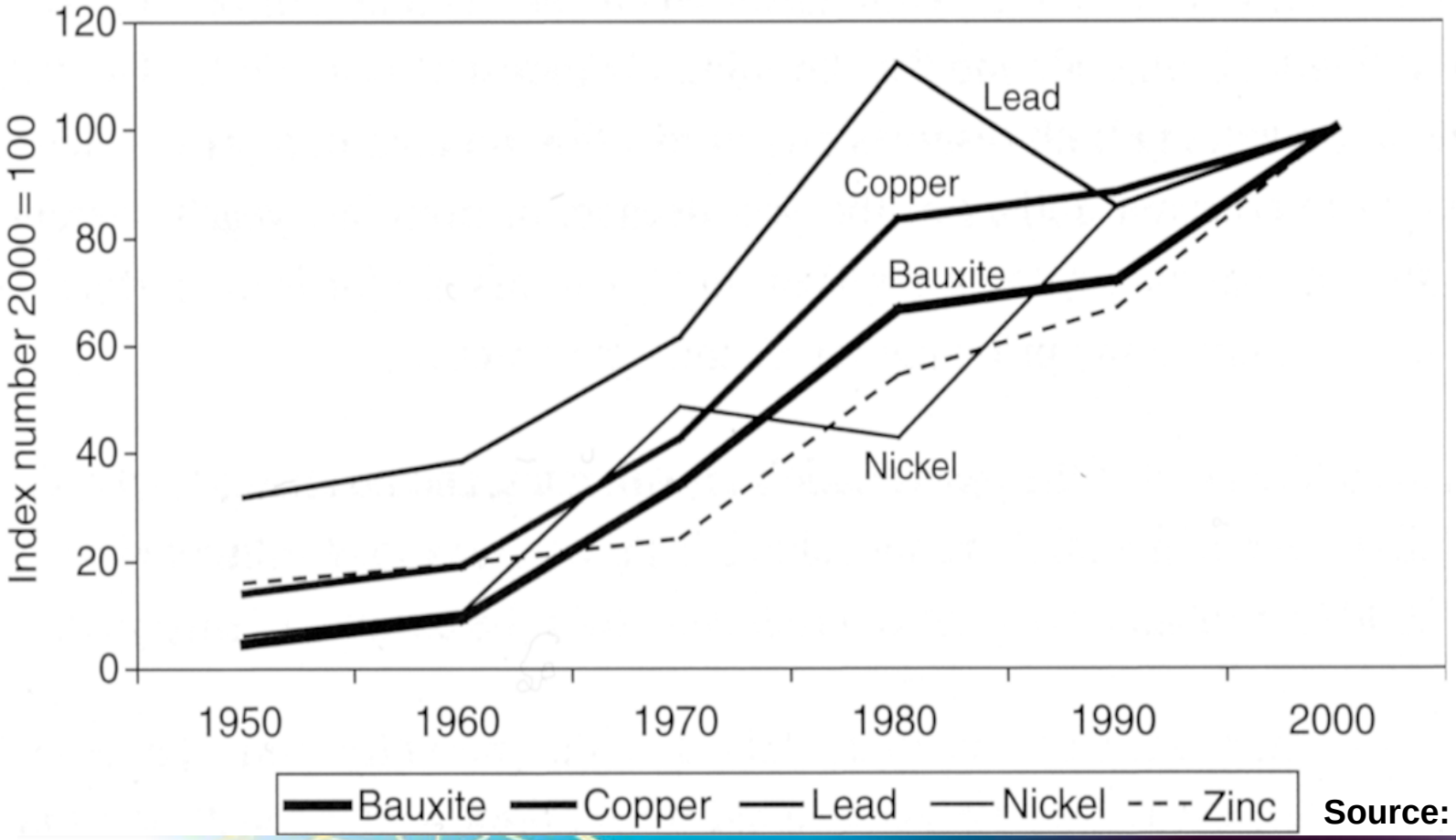
Raw Materials Group

Increasingly difficult

- Remote locations
- Harsh conditions
- Lower oregrades
- Deeper orebodies
- Long permitting process

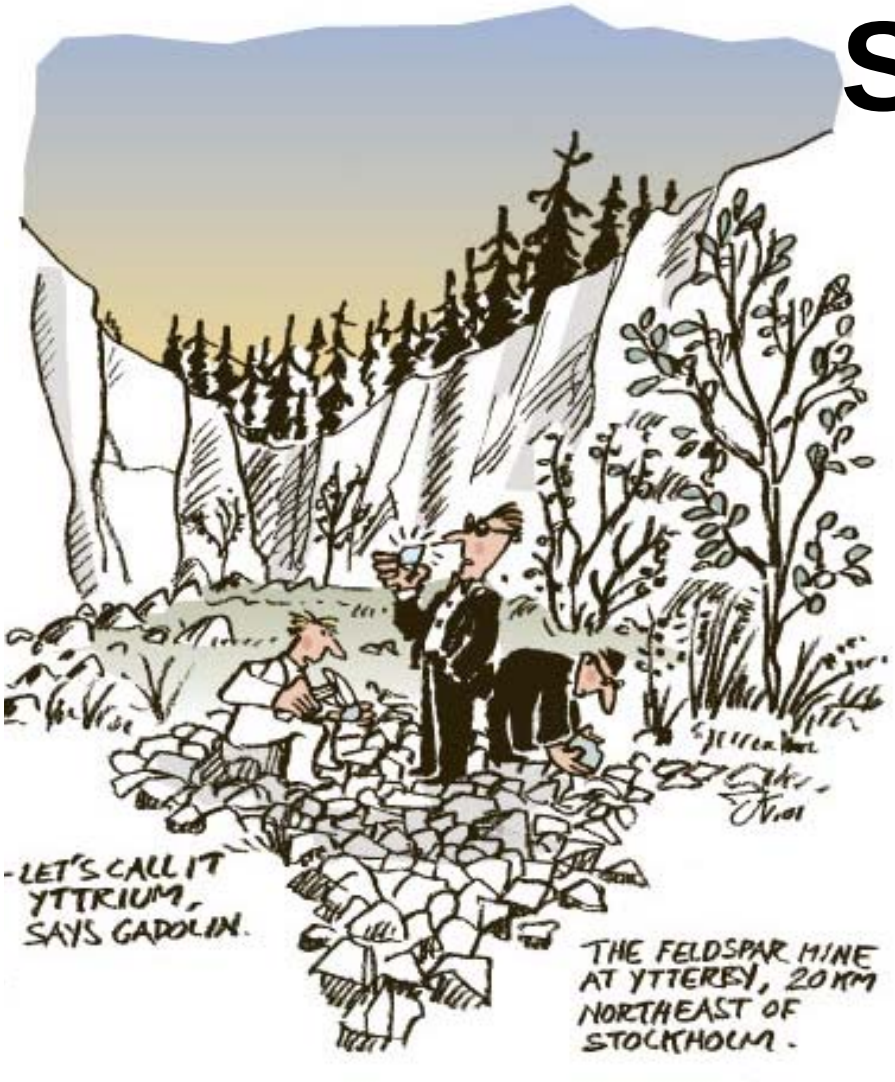
- Lack of people soon again ?!

Growth of resource base



Source: Crowson.

Supply summary

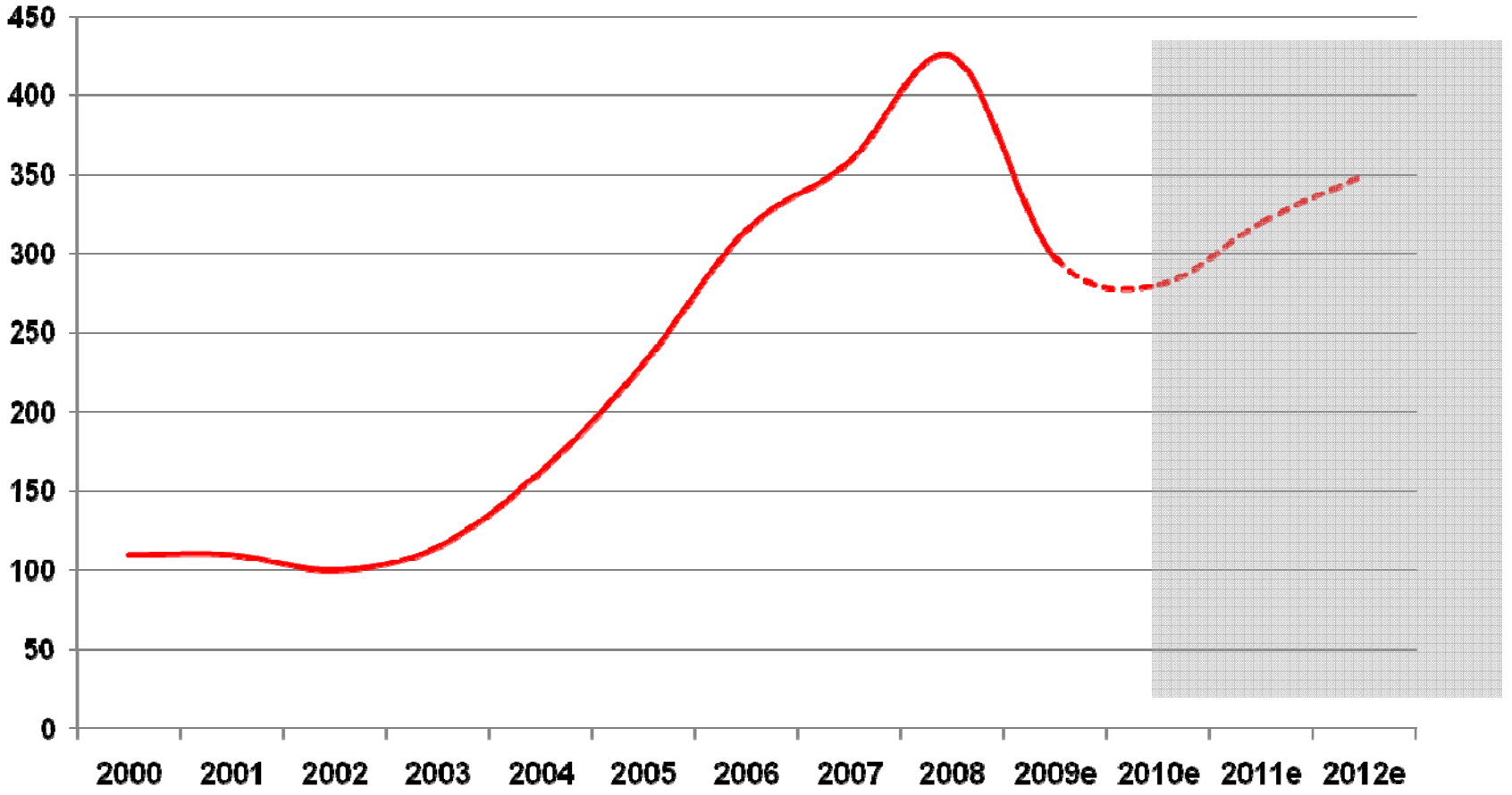


REM drawing: Kaianders Sempler.

- **Slow supply response – 10-15 years to develop a mine.**
- **Deposits deeper, lower grades and more remote areas.**
- **State influences increase, has an important role.**
- **China not the big crook – yet?**
- **Development motor.**
- **No scarcity of metals.**
- **Lack of water/energy – climate impact.**

Raw Materials Group

Metal price index



Source: Raw Materials Group, Stockholm 2009.

Raw Materials Group

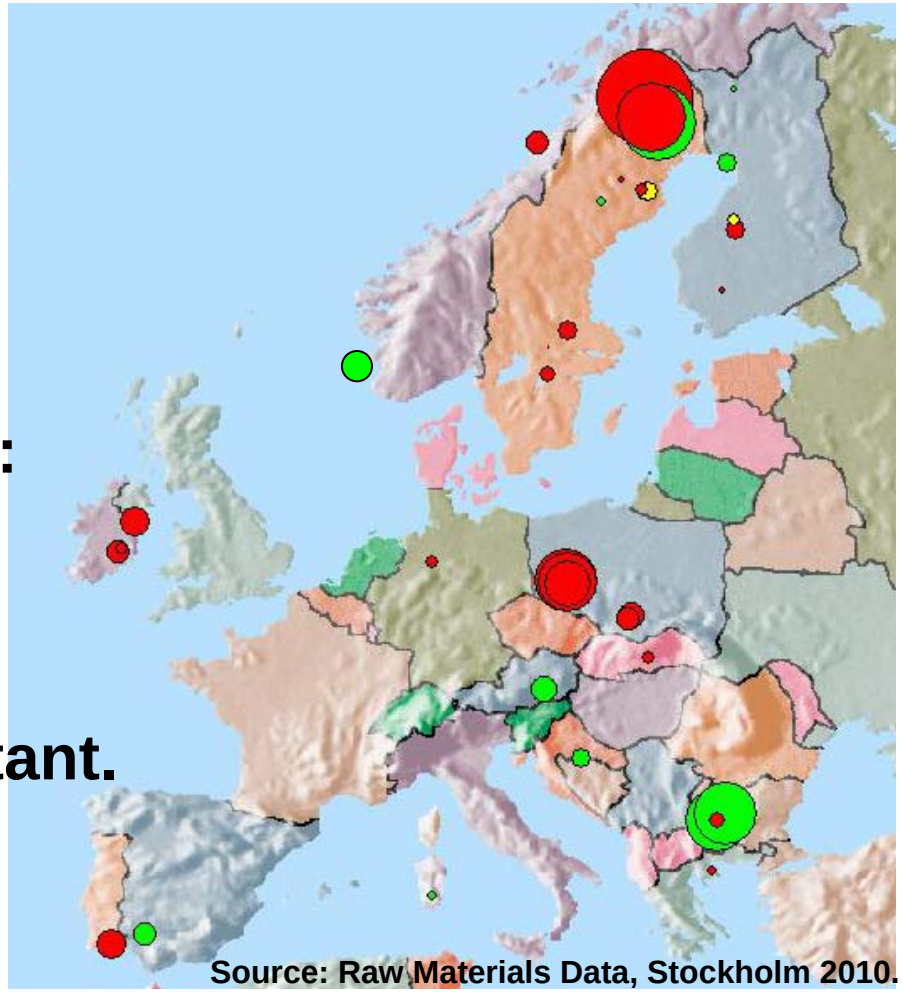
Nordic countries in a global context

Nickel drawing: Kaianders Sempler.

Raw Materials Group

European metal mines

- **Small production – but European leaders.**
- **Exploration dynamic.**
- **Nordic countries one unit: Finland, Sweden, Norway.**
- **Model mining regimes.**
- **Government's role important.**



Source: Raw Materials Data, Stockholm 2010.

Raw Materials Group

RMG Top companies 2008

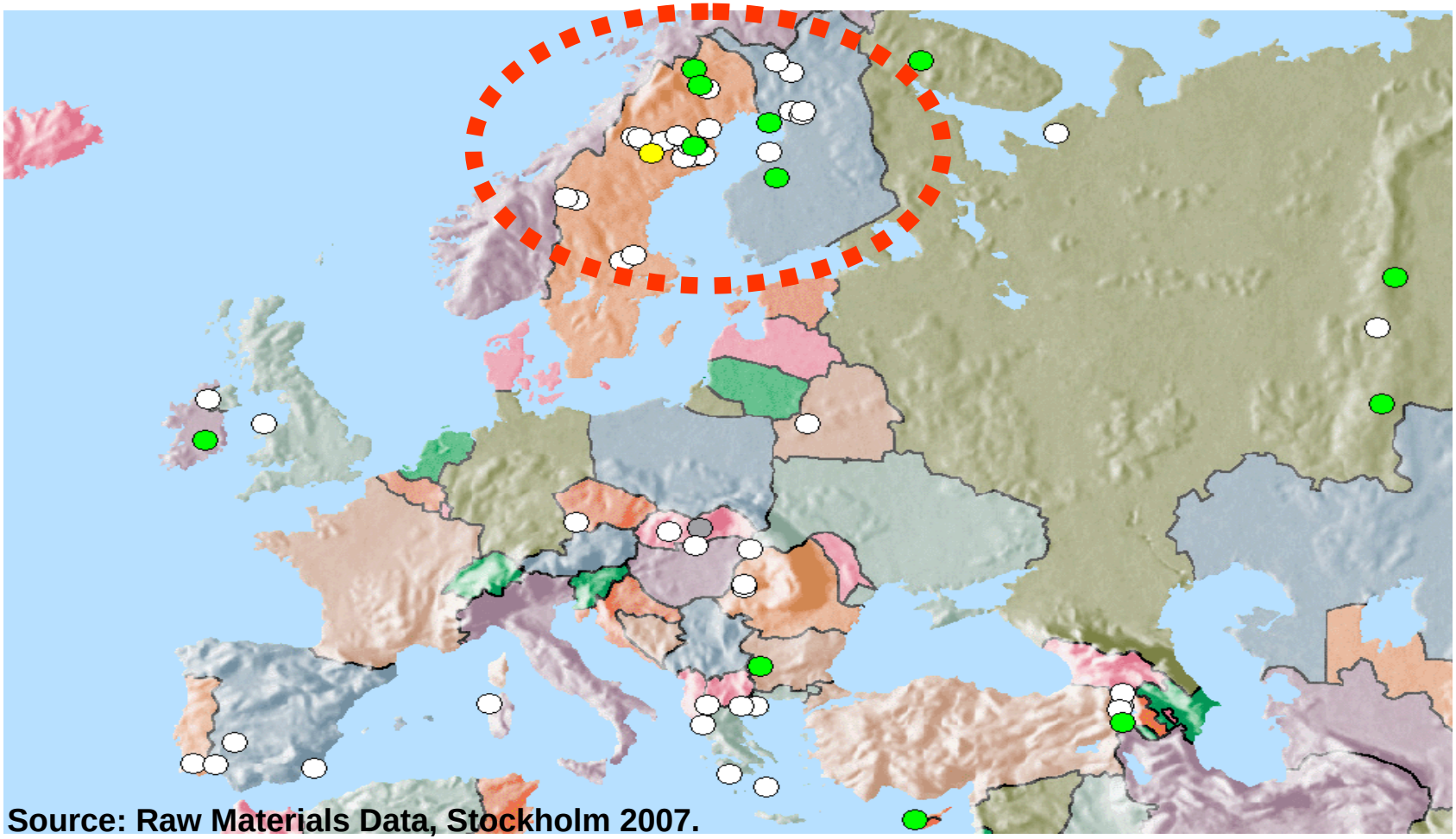
	Controlling company	Country	Share of value of mine production (%)	Cumulative value (%)
1	Vale	Brazil	6.8	6.8
2	BHP Billiton	Australia	5.2	12.0
3	Rio Tinto	UK	4.2	16.2
4	Anglo American	UK	3.6	19.8
5	Freeport McMoran	USA	2.6	22.5
6	Xstrata	Switzerland	2.1	24.6
7	Codelco	Chile	2.0	26.6
8	Norilsk Nickel	Russia	2.0	28.5
21	Polish Copper	Poland	0.61	
31	LKAB	Sweden	0.42	
64	Boliden	Sweden	0.22	
115	Agnico-Eagle	Canada	0.09	
234	Outokumpu	Finland	0.03	

Raw Materials Group

Nordic top mines 2008

	Mine	Metal	Country	Company	Rank mine
1	Kiruna	Fe	Swe	LKAB	53
2	Malmberget	Fe	Swe	LKAB	106
3	Tellnes	Ti	Nor	NL Industries	283
4	Aitik	Cu	Swe	Boliden	285
5	Garpenberg	Zn/Pb	Swe	Boliden	306
6	Zinkgruvan	Zn/Pb	Swe	Lundin Mining	386
7	Kristineberg	Zn/Pb	Swe	Boliden	460
8	Kemi	Cr	Fin	Outokumpu	485
9	Pyhäsalmi	Zn	Fin	Inmet	500
10	Rana	Fe	Nor	L Nilsen & söner	781
11	Svartliden	Au	Swe	Dragon	847
12	Orivesi	Au	Fin	Dragon	927

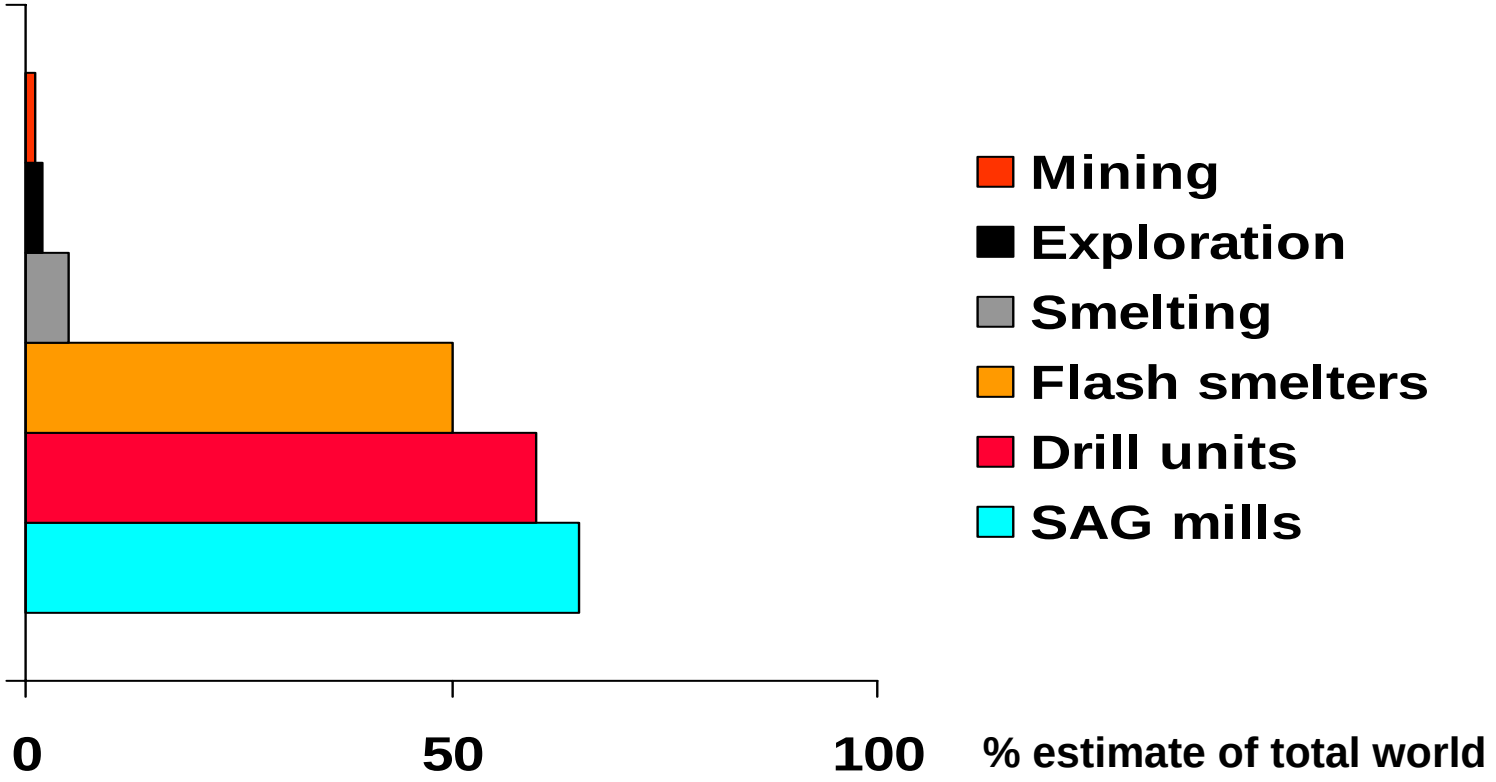
Mining projects



Source: Raw Materials Data, Stockholm 2007.

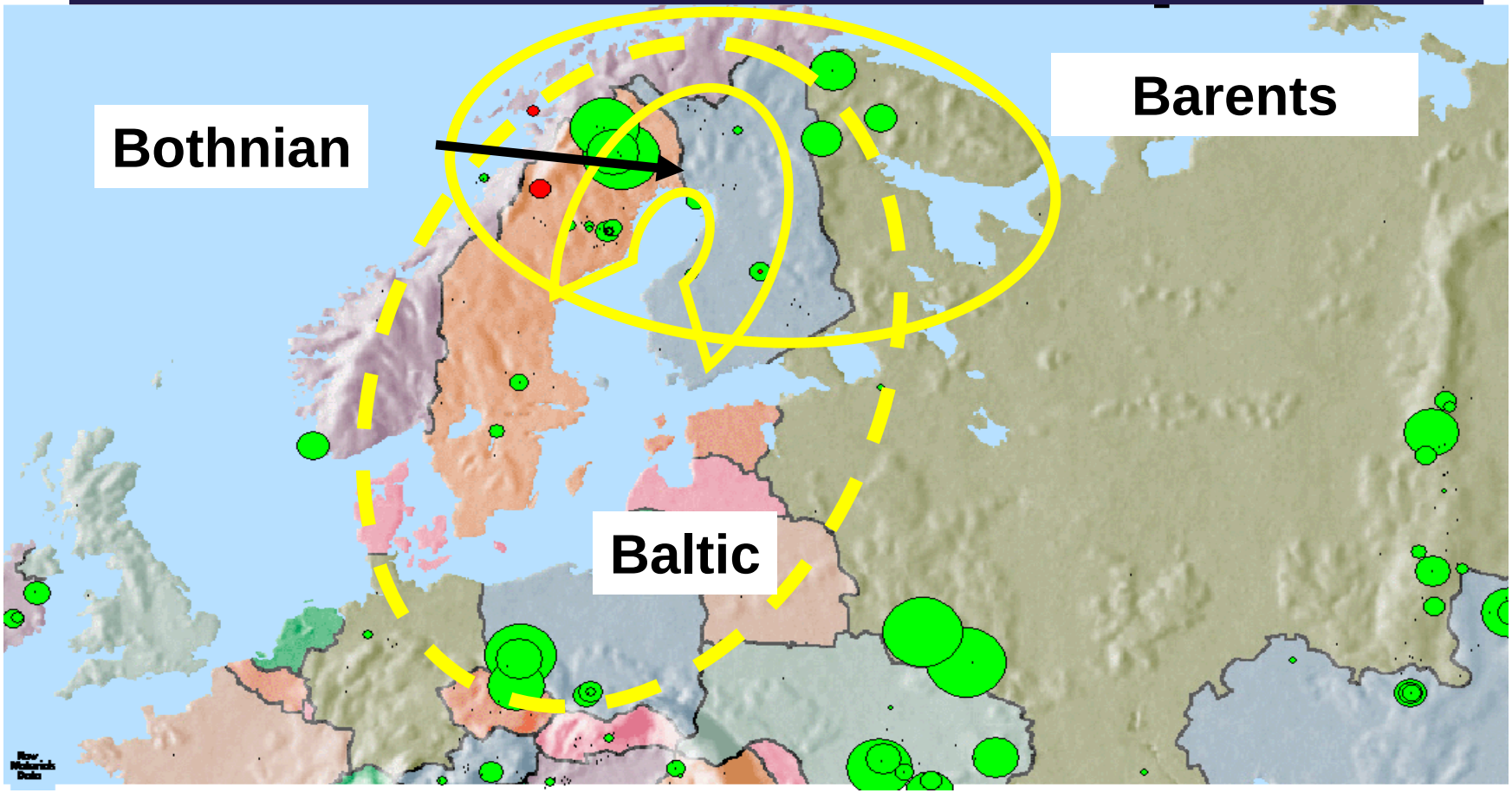
Raw Materials Group

Bothnian cluster market shares



Source: Noras, Ericsson 2006.

Mining cluster in northern Europe



Source: Noras, Ericsson 2006.

Raw Materials Group

Nickel drawing: Kaianders Sempler.

Nordic countries

- Small globally but leaders in Europe.
- Revival with international companies.
- Regional growth motor.
- Cluster world leading.
- Opportunities in new strategic minerals.
- Political role under-played: in Europe and globally.
- R&D key to future.

Raw Materials Group

Policy implications

Manganese drawing: Kaianders Sempler.

Raw Materials Group

Policy implications

- Policy - legislation – regulations.
- Nordic countries act as one unit.
- European leaders.
- Development corridors/centres.
- Support clusters.
- Research & development.
- Government's role important.
- Global/European role – Mining for Development.
- Long term efforts.

Manganese drawing: Kaianders Sempler.

Raw Materials Group

Global mining 2030 !

- **Metals still foundation for growth and wealth.**
- **Deep sea deposits important.**
- **China controls largest mining companies.**
- **Nordic countries Europe's treasure chest for minerals.**
- **Mining remains in Nordic countries – manufacturing moves to Thrid World.**
- **Nordic development model applied around the world.**
- **New technologies makes low grade ores useful.**
- **Water and energy lean technologies.**

Copper drawing: Kaianders Sempler.

Raw Materials Group

Kiitos/Tack!

Raw Materials Group

Magnus Ericsson

PO Box 3127

SE-169 03 Solna, Sweden

Tel: +46-8-744 00 65

Fax: +46-8-744 0066

E-mail: magnus.ericsson@rmg.se

www.rmg.se

Tungsten drawing: Kaianders Sempler.

Raw Materials Group