

Copper Consumption Dynamics & the Adequacy of the Exploration and Project Pipeline

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with input from

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TD Securities Total Resource Commodities Conference

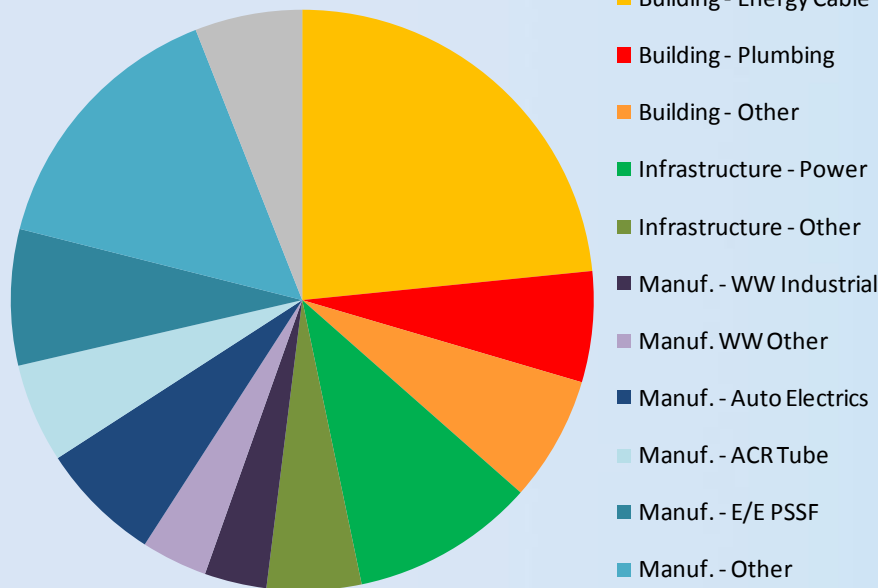
Toronto: June 23-24th 2011

Part 1

Demand

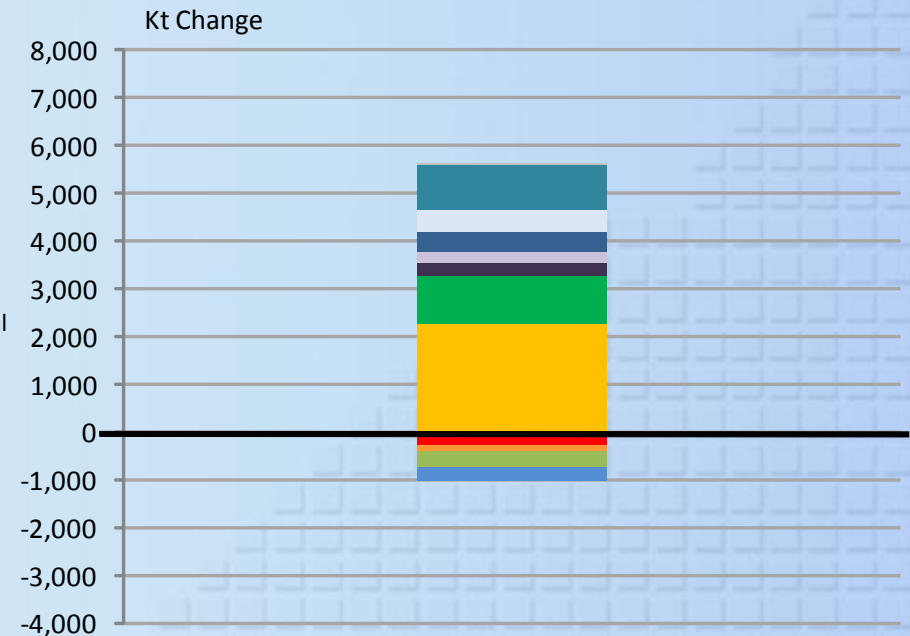
Lessons from History (1): Consumption Growth is by No Means Even by Sector

All Products - Split by Sector



Total: 22.17 Mt
(Total Cu)

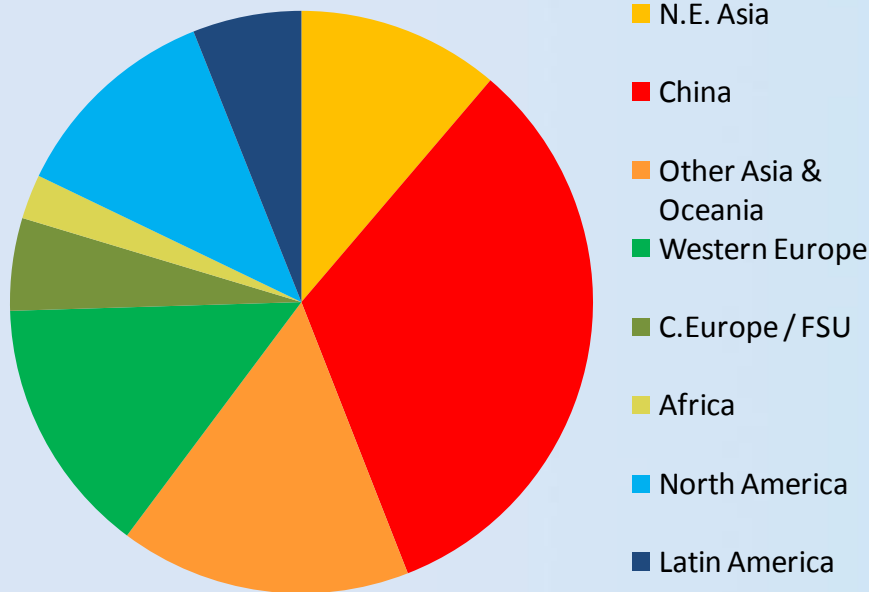
Market Growth 1998 to 2009



Change 1998-2009: 4.41 Mt - 26%

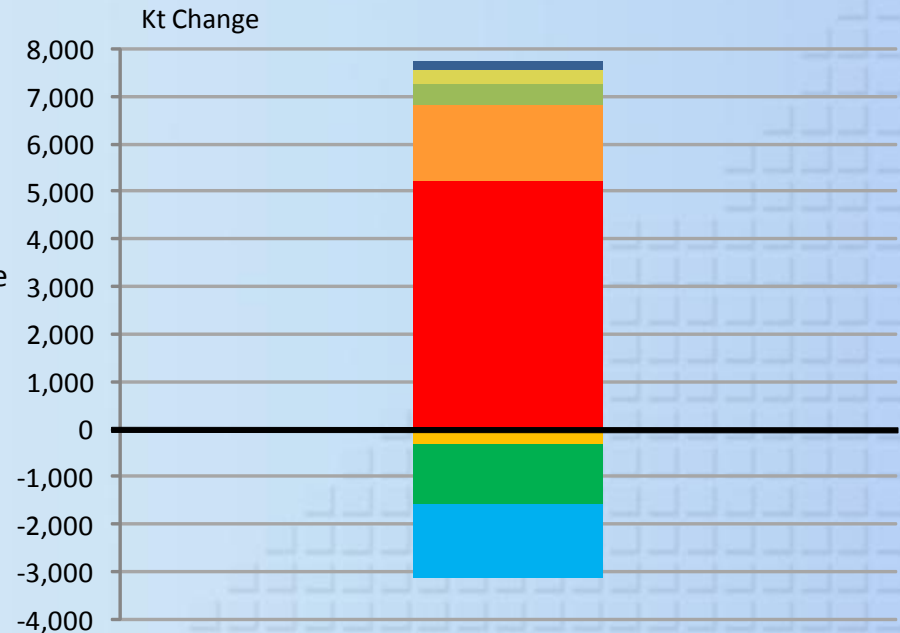
Lessons from History (2): Consumption Growth even More Focused by Region

All Products - Split by Region



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(Total Cu)

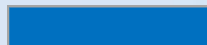
Market Growth 1998 to 2009



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Total Copper's Current Markets: Heavy Focus on Electrical

	WIRES, CABLES & LEADS			MILL, FOUNDRY & OTHER PRODUCTS			TOTAL
	Energy / Bare Cable & Wire	Telecom/ Data Cable	Winding Wire	Copper Tube	Cu/Alloy PSSF	Alloy RBS & Other	All Products
Building Construction	18%	1%	0%	4%	1%	5%	30%
Power Network	6%		2%		0%	3%	11%
Telecom Infrastructure	0%	3%			0%		4%
Industrial Machinery	4%	0%	3%	0%	1%	8%	16%
Automotive	3%		1%		3%	0%	8%
Air Conditioners	0%		1%	6%		0%	7%
Electrical & Electronic	4%	0%	3%		4%	1%	12%
General & Other	5%	0%	1%	0%	4%	3%	12%
TOTAL	41%	5%	11%	10%	13%	19%	100%



Major markets and those to experience big volume change

Society Needs and Aspirations: The Long Term Drivers of Copper Use

NEEDS	IMPLICATIONS
Survival (Society)	Sustainable environment
	Captive ownership of resources
Survival (individual)	Food & water
	Focus on health and safety, especially for the elderly
Continuity	Infrastructure for more urban population

ASPIRATIONS	IMPLICATIONS
Personal wealth	Wider ownership of objects
	Ease of use, automation etc.
Ease and comfort	Rich functionality
	Interactivity
Stimulation	Focus on entertainment

Changes in the Energy Economy Driven by Society Needs

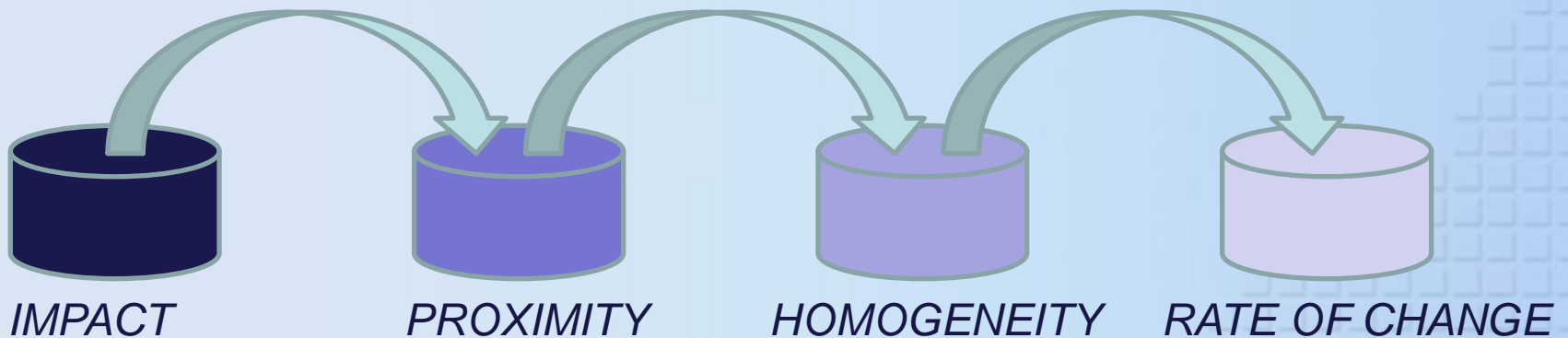
BASICS	IMPLICATIONS	DETAILS
Cleaner energy sourcing	Lower emissions in electricity generation	Use clean renewables (wind, solar, hydro, marine, geothermal), reduce other emissions (carbon capture)
Diverse energy sourcing	Local sourcing of electricity	Use other renewables (biomass, biofuel), integrate local electricity resale (eg. small solar, charged electric cars)
Reduced energy losses	Better loading of electricity networks	Smart grid integration of distributed generation, smart grid electricity use management, lower transmission loss
Reduced energy use	Energy efficient design	Design of electricity equipment for efficiency. building and system design for efficiency. Non fossil fuel burning transport
Design for an urban environment	Energy efficient behaviour	Enforced, price induced or discretionary behaviour, ICT-enabled behaviour (eg. omit unnecessary travel, homeworking etc.)
Design for safety and ease of use	In-building design for the elderly and safety	Upgraded building wiring systems to match safety standards, Smart Ageing system functionality

Implications for Copper of Developments in the Energy Sector Largely Positive

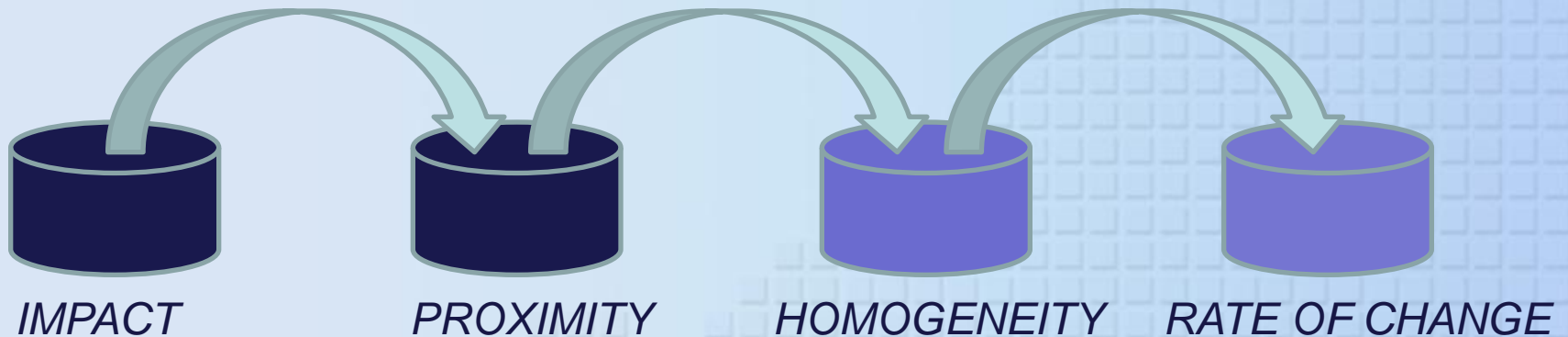
SECTORS	IMPLICATIONS	ACTUALLY OR POTENTIALLY COPPER INTENSIVE
Electricity generation	Generators	Solar photovoltaic, concentrating solar & wind, marine generation. Carbon capture. Generation & desalination
Electricity networks	Networks	Renewables integration. Network building & renewal. Additional transformers. Marine focus. Cable undergrounding
Transport	Road & Rail	Hybrid and fully electric cars. Fuel cell cars. High speed electric rail systems
Other equipment	Motors etc.	Efficient industrial motors. Efficient motors in transport, electrical & electronic equipment
Buildings	Building System & Design	Enhanced wiring systems, industrial & home automation, integrated energy generation and HVAC systems
Cross sector technology	Various	Energy storage (lithium ion batteries & other), power electronics, other densely packaged electronics

.. But, Substitution and Other Threats Greater at High Prices

Moderate Prices: Rate of Market Loss Small



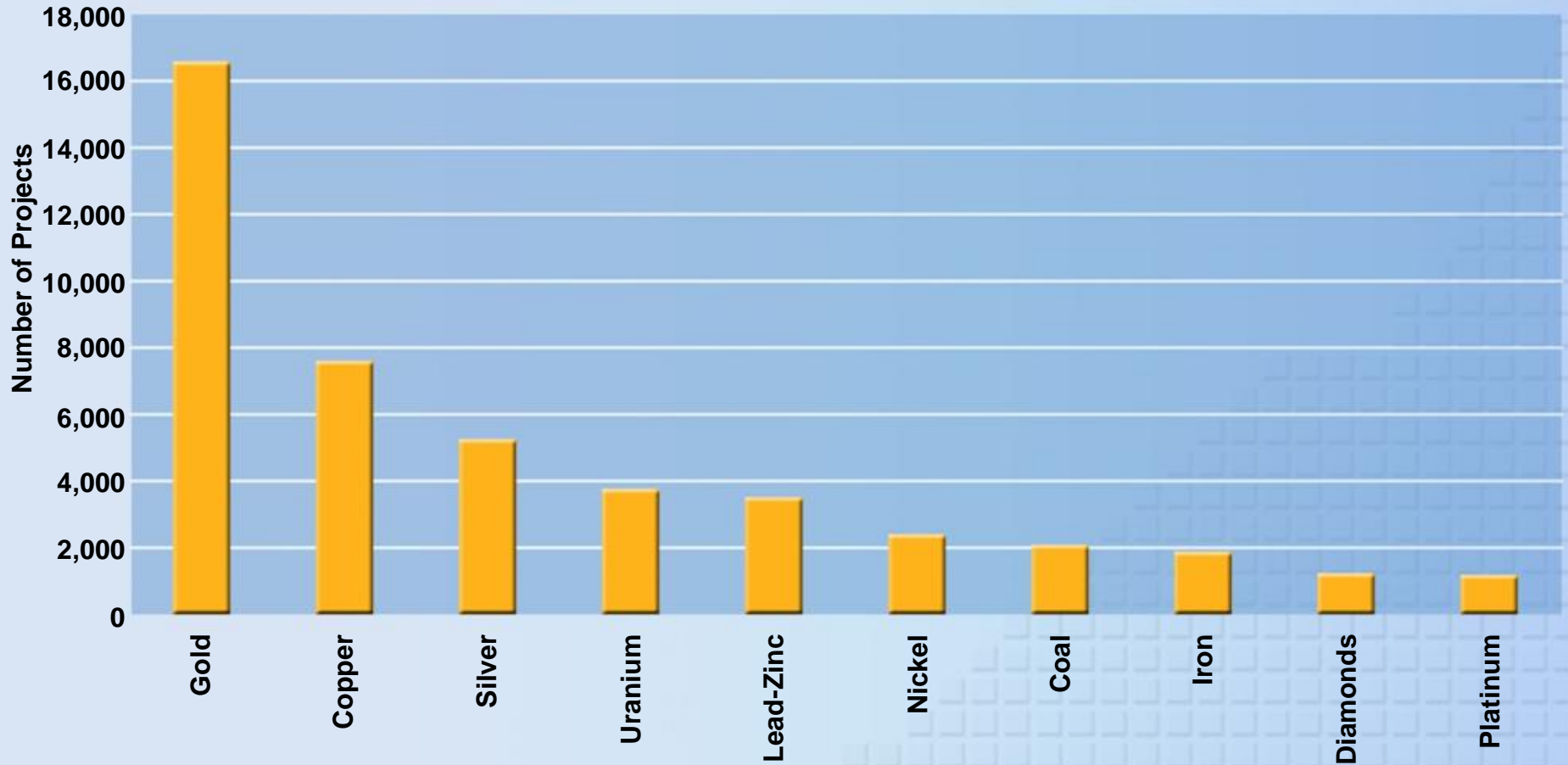
Higher Prices: Faster Market Loss



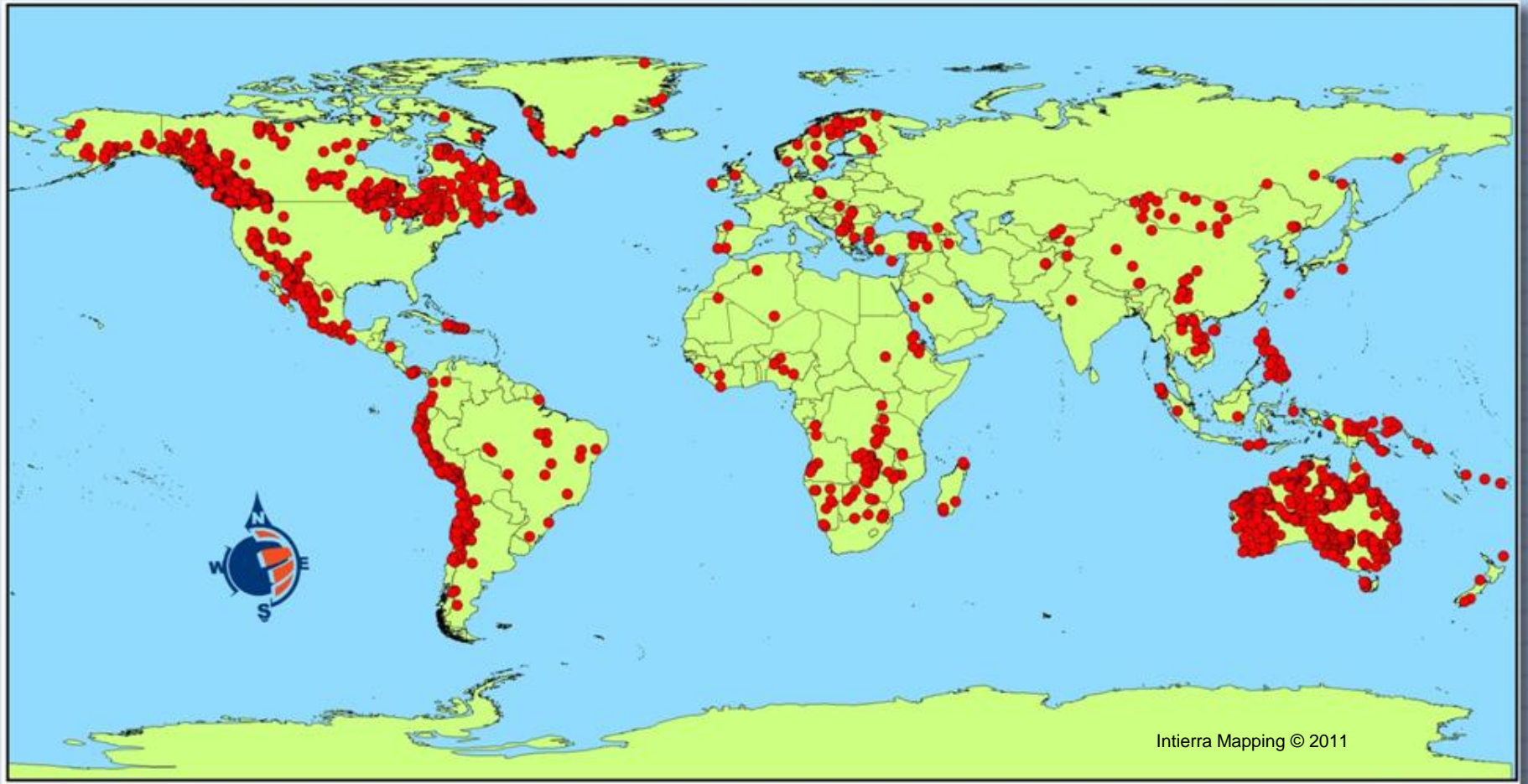
Part 2

Adequacy of the Exploration & Project Pipeline

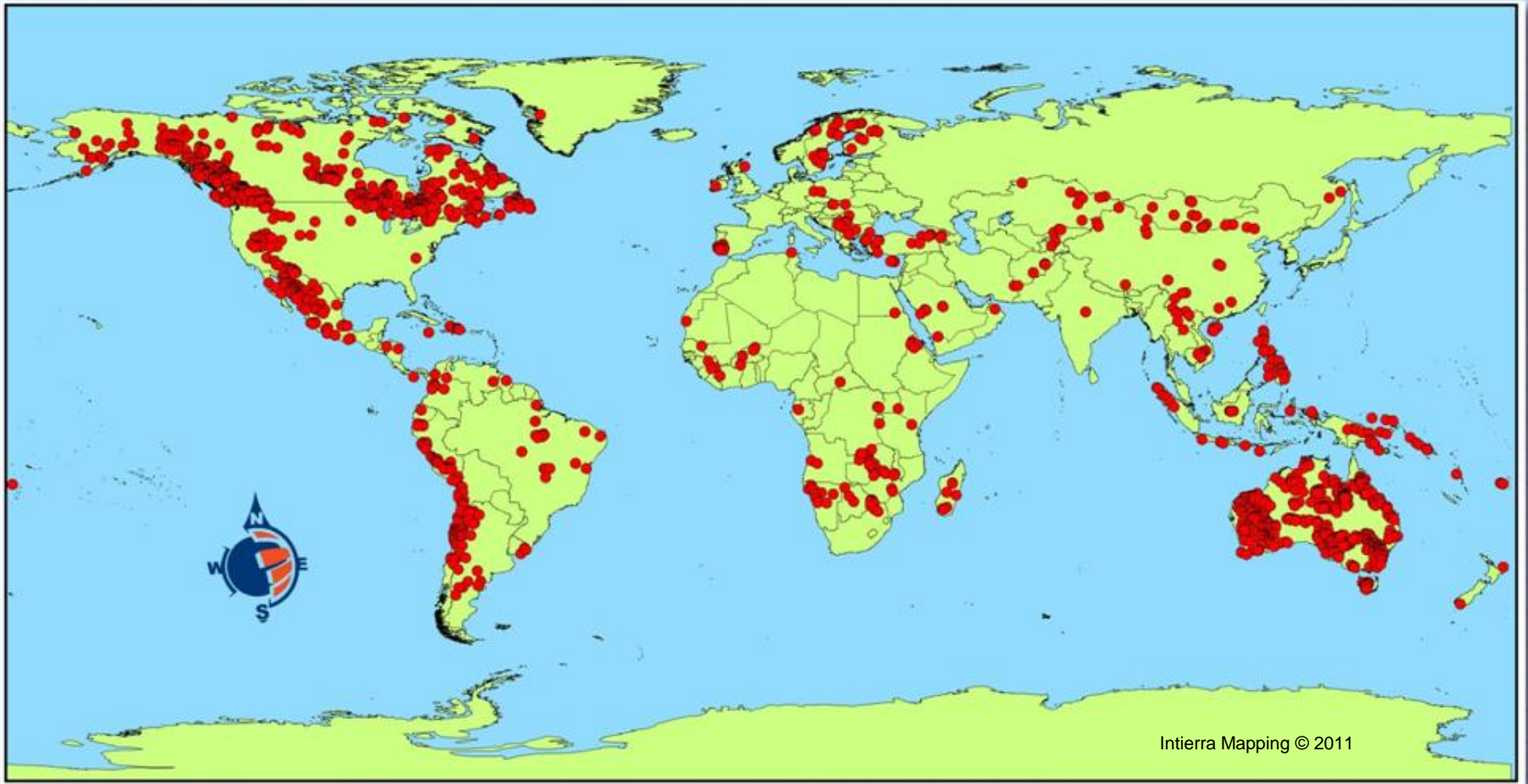
Top Ten Commodities By Global Projects



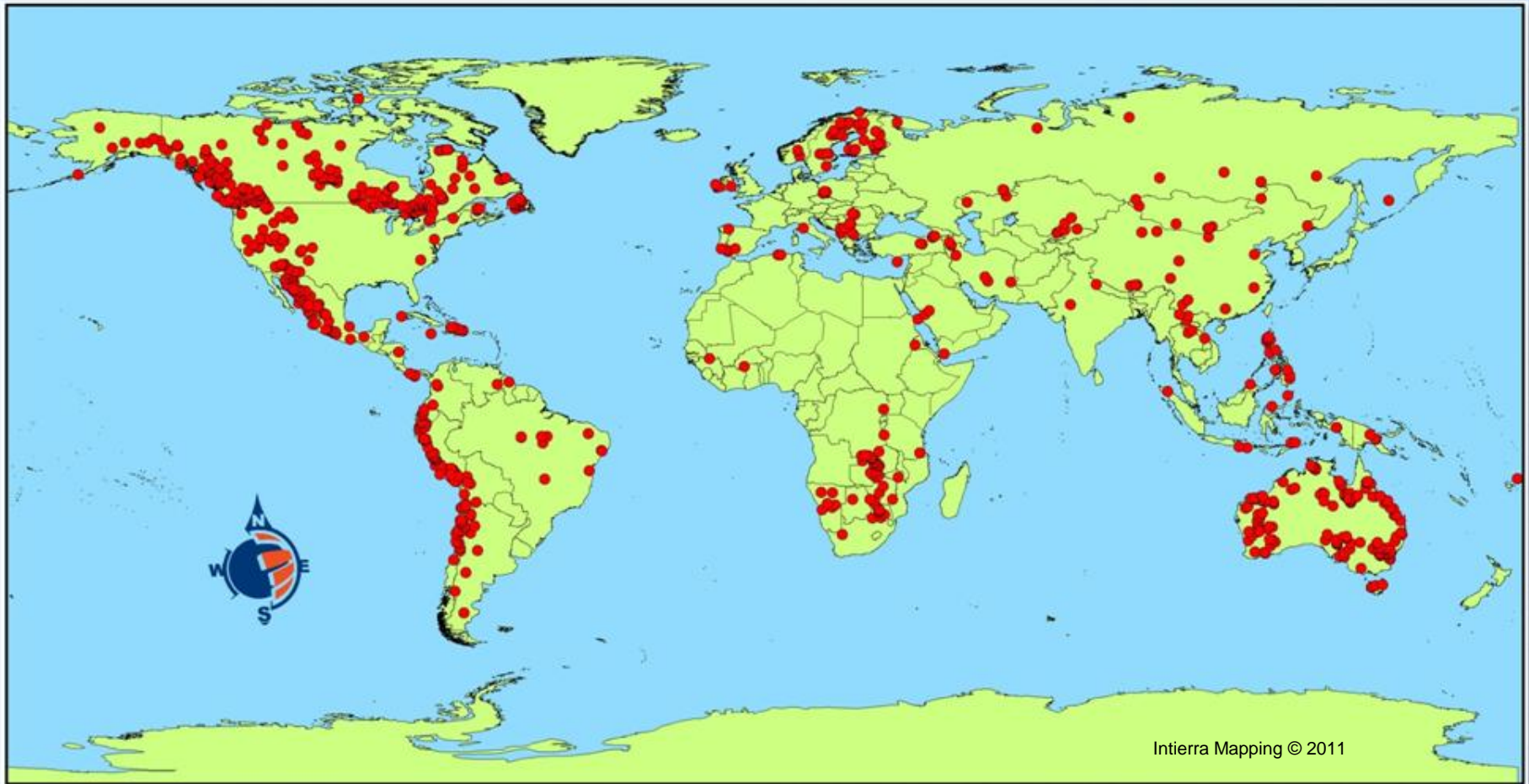
Grass Roots Stage Projects with Copper Component



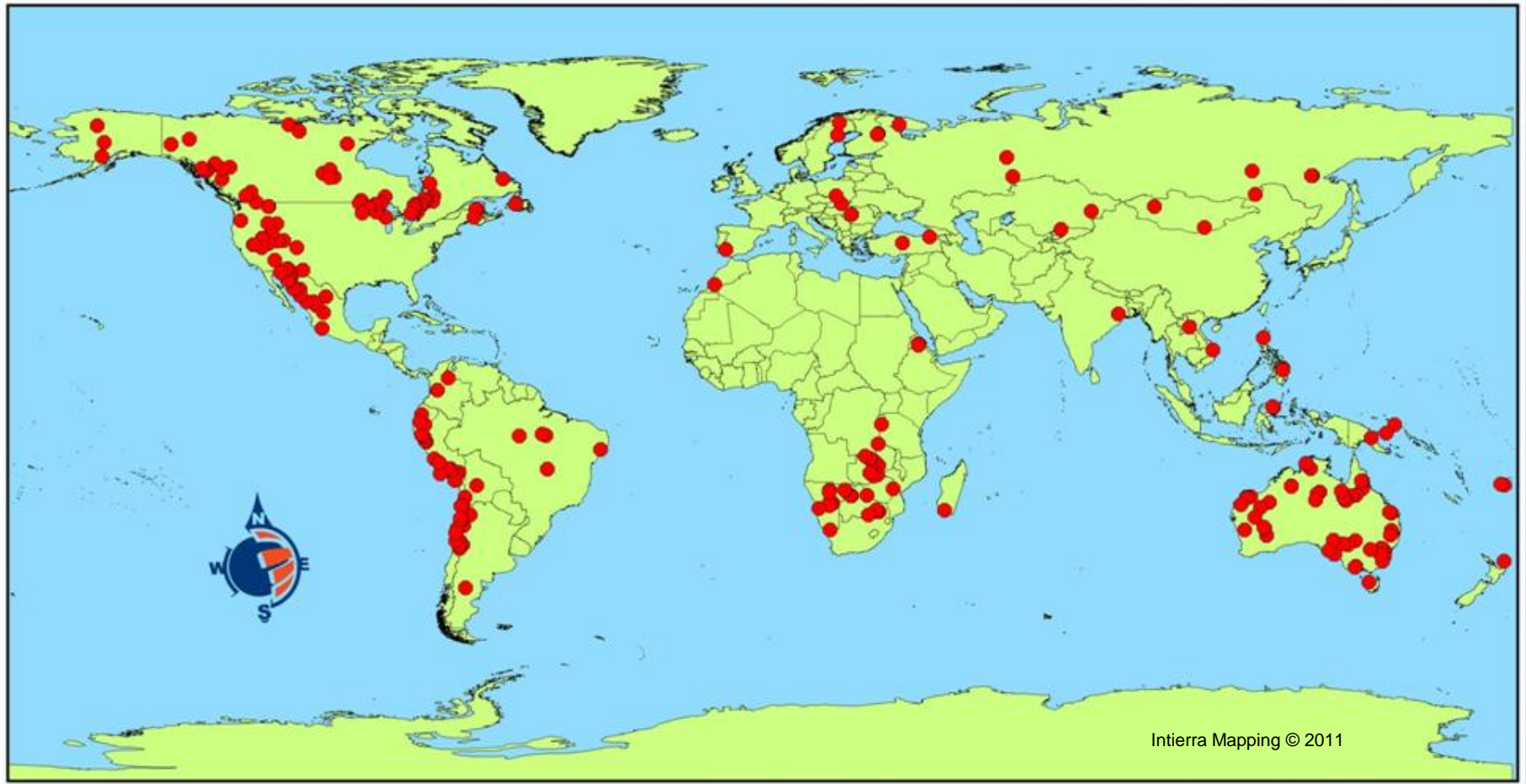
Exploration Stage Projects with Copper Component



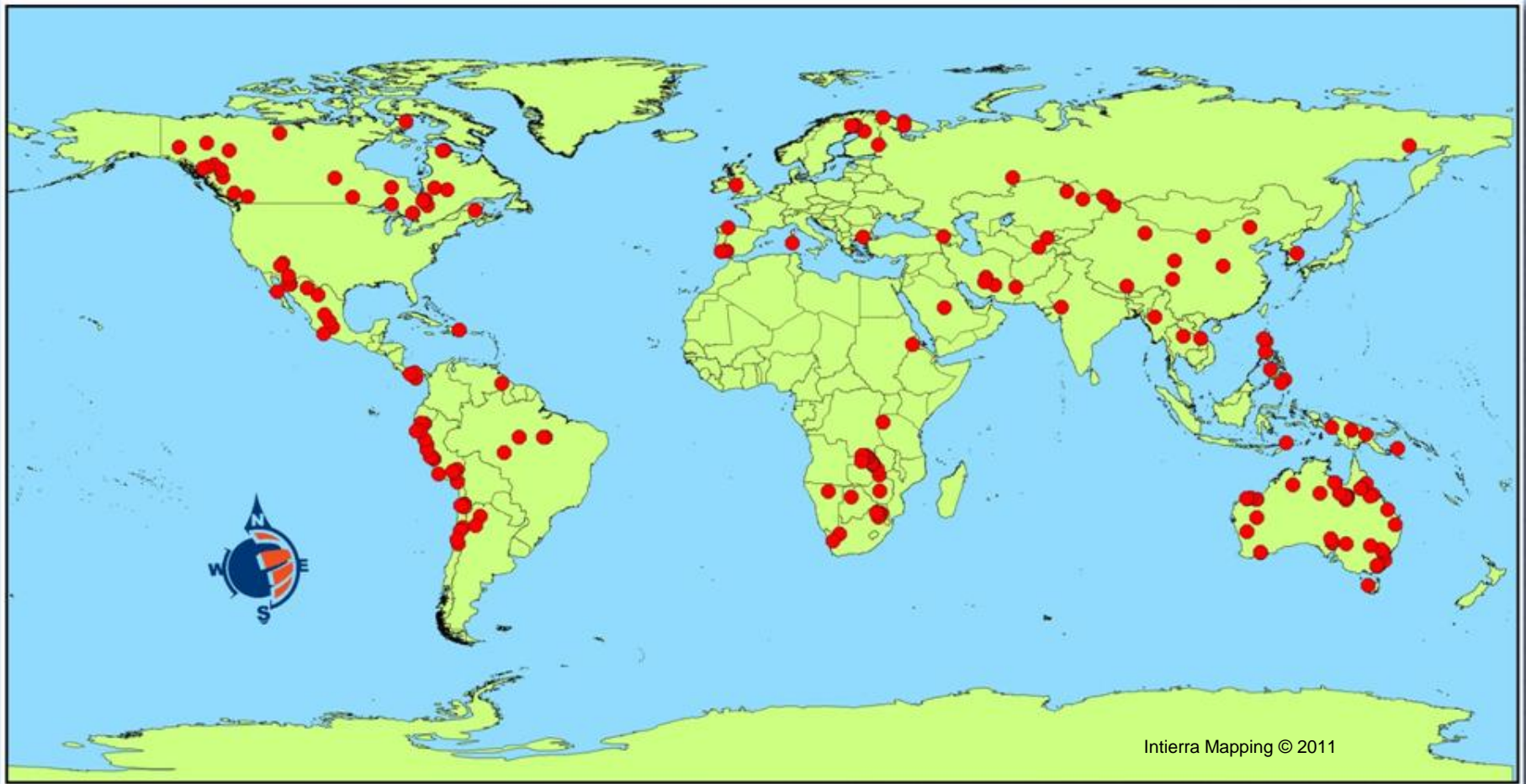
Advanced Exploration Stage Projects with Copper Component



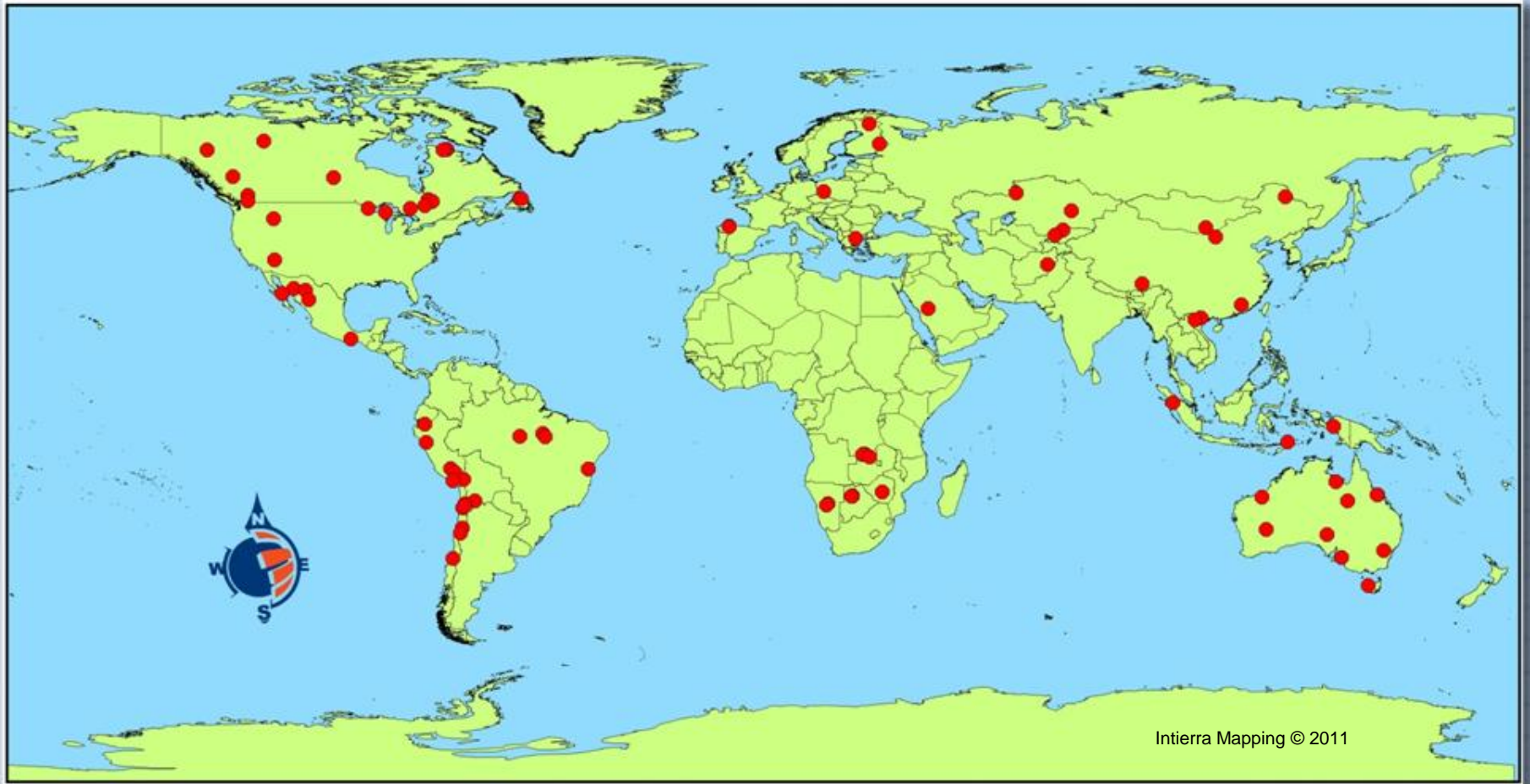
Pre-Feasibility/Scoping Stage Projects with Copper Component



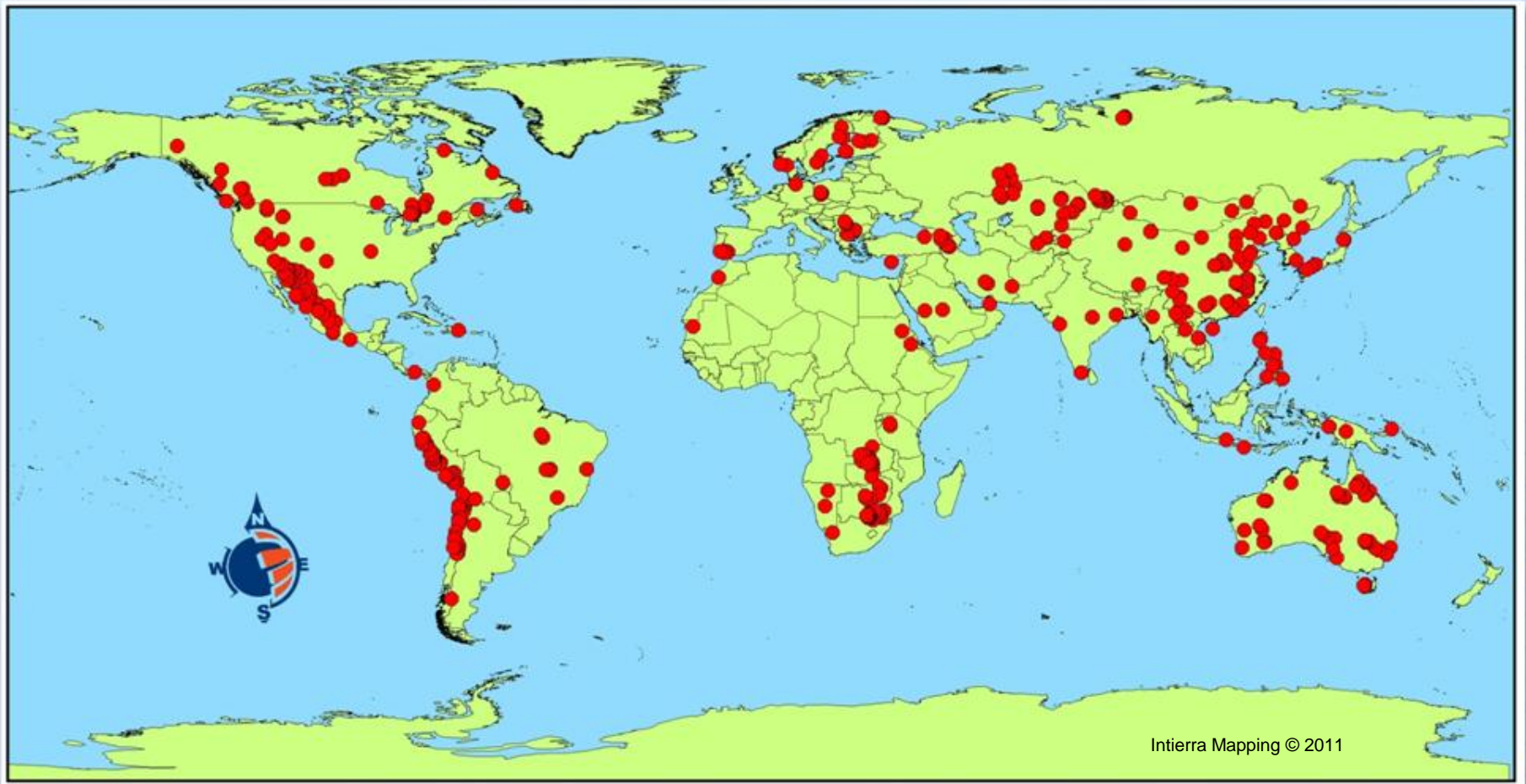
Feasibility Stage Projects with Copper Component



Construction Stage Projects with Copper Component



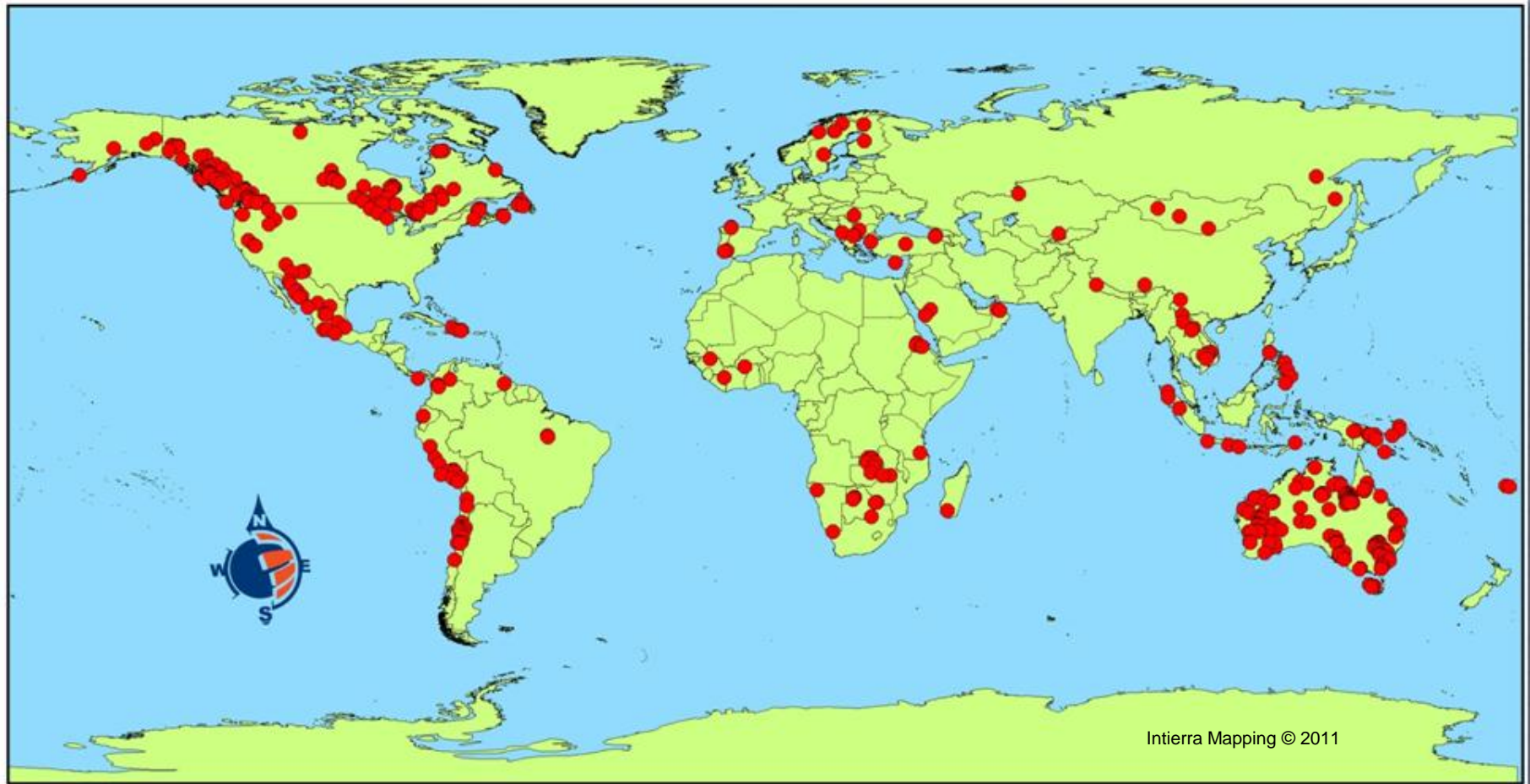
Operating Mines with Copper Component



Drilling – Feeding the Copper Pipeline

<u><i>Time Frame</i></u>	<u><i># of Projects</i></u>
January – December 2010	460
January – March 2010	161
January – March 2011	213
An increase of over 32%	

Drilling for Copper in 2010



Drilling for Copper in 2010

<i>Status</i>	<i>Projects</i>	<i>%</i>
Exploration	215	47
Adv. Exploration	109	24
Pre-Feas/Scoping	59	13
Feasibility Study	32	7
Operating	28	6
Construction	15	3
Grass Roots	2	<1

The Copper Project Pipeline

<u><i>Global Gold Projects</i></u>	<u><i>Stage</i></u>	<u><i>Projects</i></u>	
Grass Roots (no drilling)	Early	5544	36%
Exploration (limited drilling)	Early	4720	31%
Advanced Exploration	Late	2517	17%
Pre-Feasibility/Scoping	Late	555	4%
Feasibility	Late	433	3%
Construction	Late	185	1%
Operating Mines		<u>1189</u>	<u>8%</u>
Total		15,143	100%

<u><i>Global Copper Projects</i></u>	<u><i>Stage</i></u>	<u><i>Projects</i></u>	
Grass Roots (no drilling)	Early	2437	36%
Exploration (limited drilling)	Early	2275	33%
Advanced Exploration	Late	1040	15%
Pre-Feasibility/Scoping	Late	269	4%
Feasibility	Late	198	3%
Construction	Late	93	1%
Operating Mines		<u>519</u>	<u>8%</u>
Total		6,831	100%

Commodity Pipeline Comparison

	<u>Early</u>	<u>Late</u>
Gold	67%	23%
Copper	69%	23%
Silver	61%	27%
Uranium	81%	16%
Lead-Zinc	67%	24%
Nickel	68%	23%
Diamonds	79%	13%
PGE's	70%	22%

New Mining Projects 2011 – 2015

Year	Annual kt	Projects
2011	626	16
2012	1,760	22
2013	1,296	17
2014	974	8
2015	480	3

2011-2015 Total LOM Production: 66 Projects, 102,258 kt

>2015 Total LOM Production: 55 Projects, 58,825 kt

Note: These projects are currently in feasibility stage or construction.
No analysis has been applied for viability of start dates.

New Mining Projects Production 2011 – 2015 Top Countries

<u>Country</u>	<u>Projects</u>	<u>Annual kt</u>	<u>LOM kt</u>
Peru	11	1,787	34,025
Chile	6	828	13,820
Canada	10	349	6,617
Afghanistan	1	260	4,160
Panama	1	250	7,500
Ecuador	2	239	4,780
Brazil	1	200	3,600
USA	4	195	3,765
Mongolia	1	191	11,460
Kazakhstan	2	105	1,300
Zambia	1	100	2,800

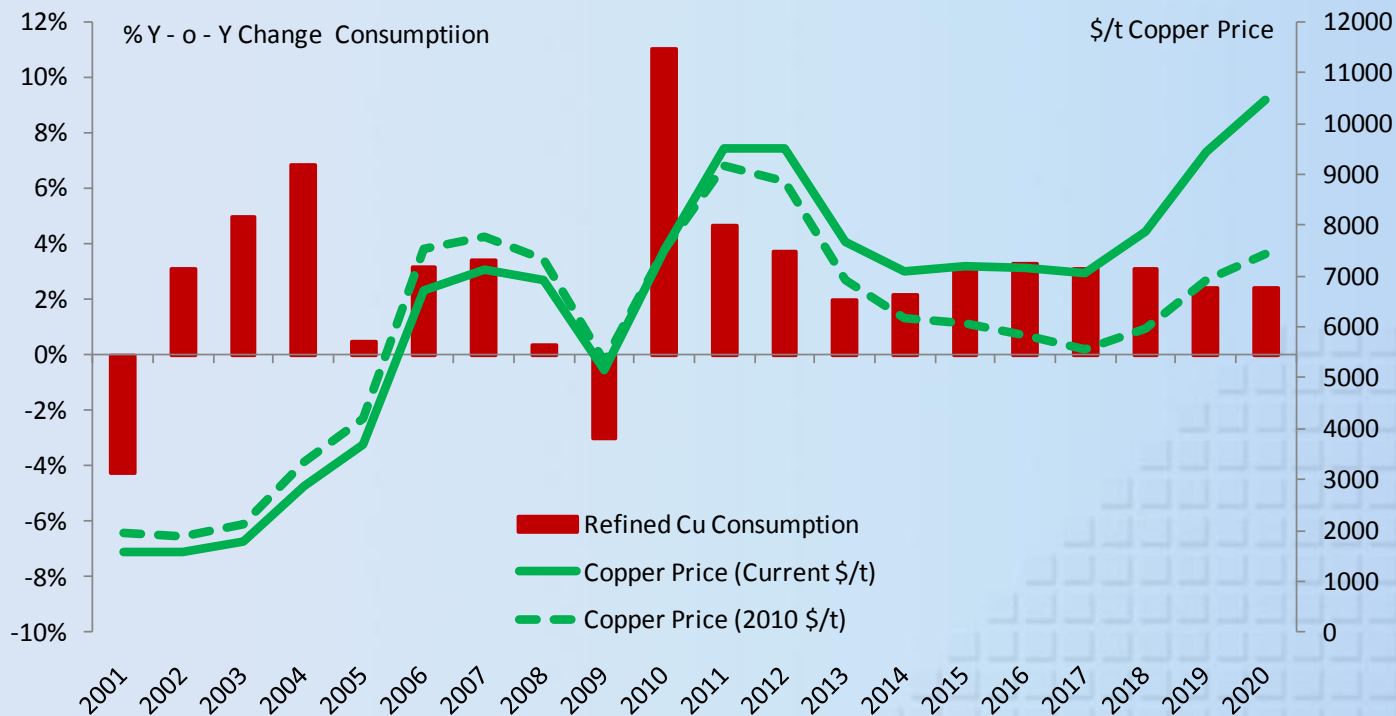
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Part 3

Market Balance and Prices

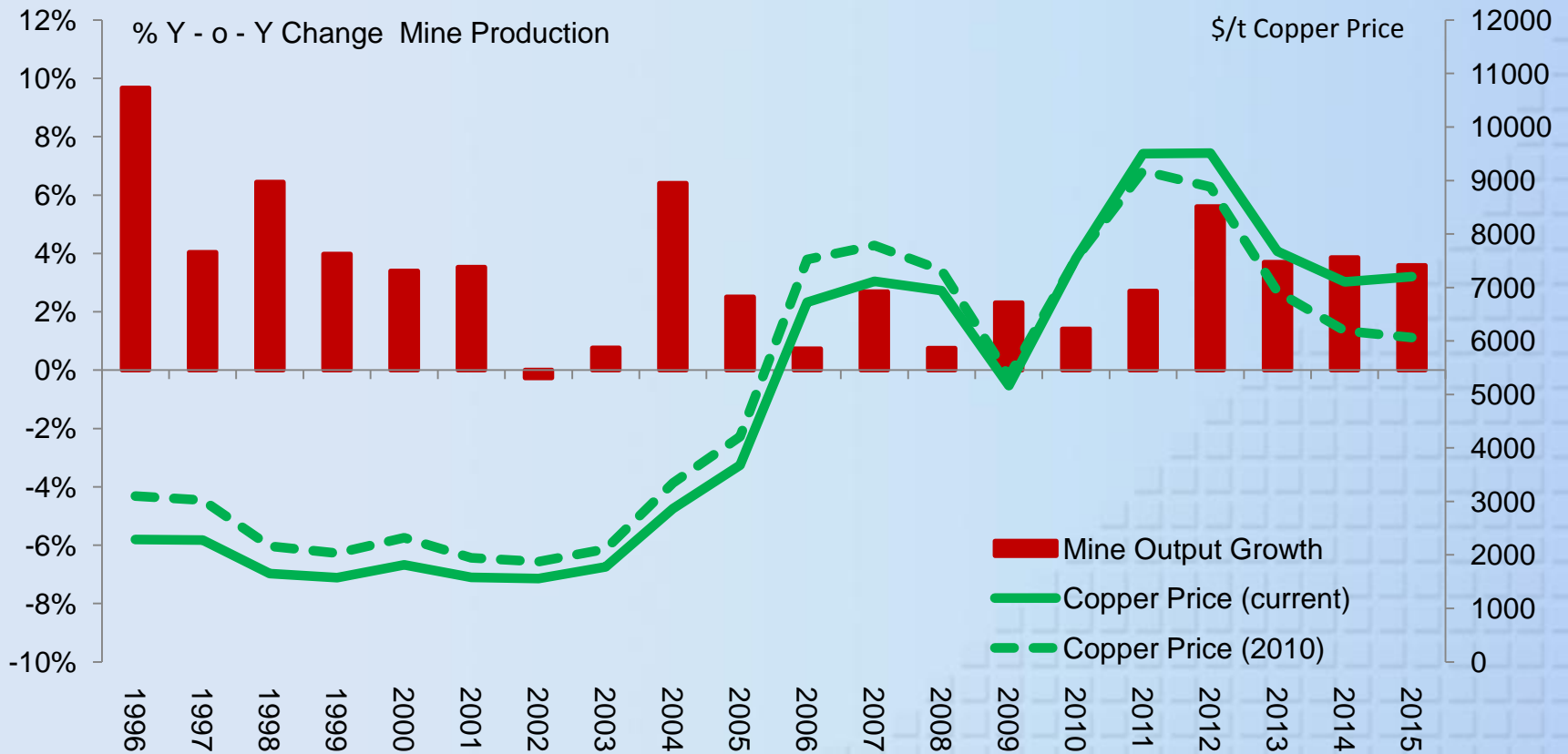
BME Refined Consumption and Price Forecasts

Refined Copper Use and the Copper Price

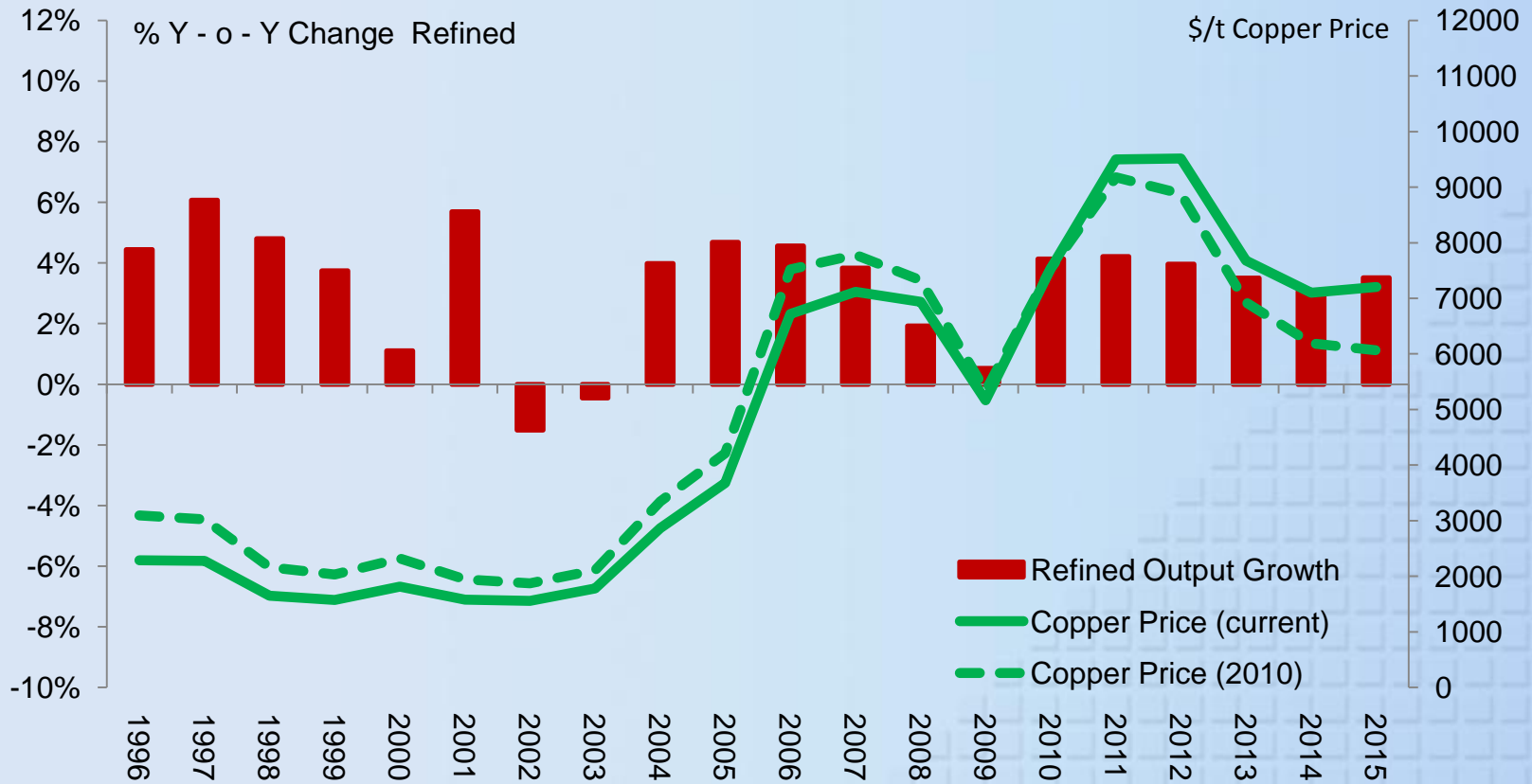


- We forecast around 3% p.a. consumption growth
- High prices would push growth lower, with substitution and thrifting

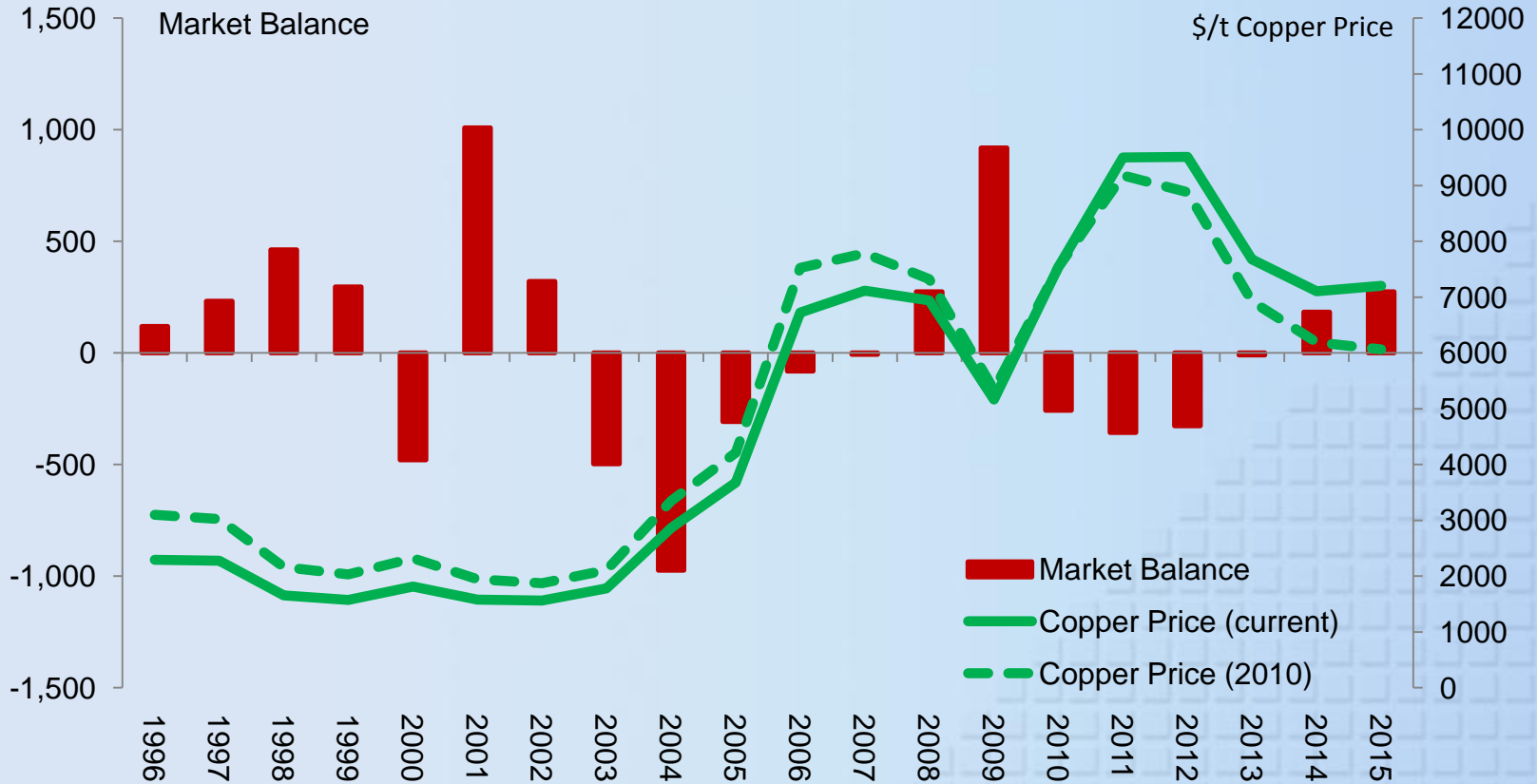
Global Mine Production and the Copper Price



Global refined Production and the Copper Price



Annual Refined Market Balance and the Copper Price

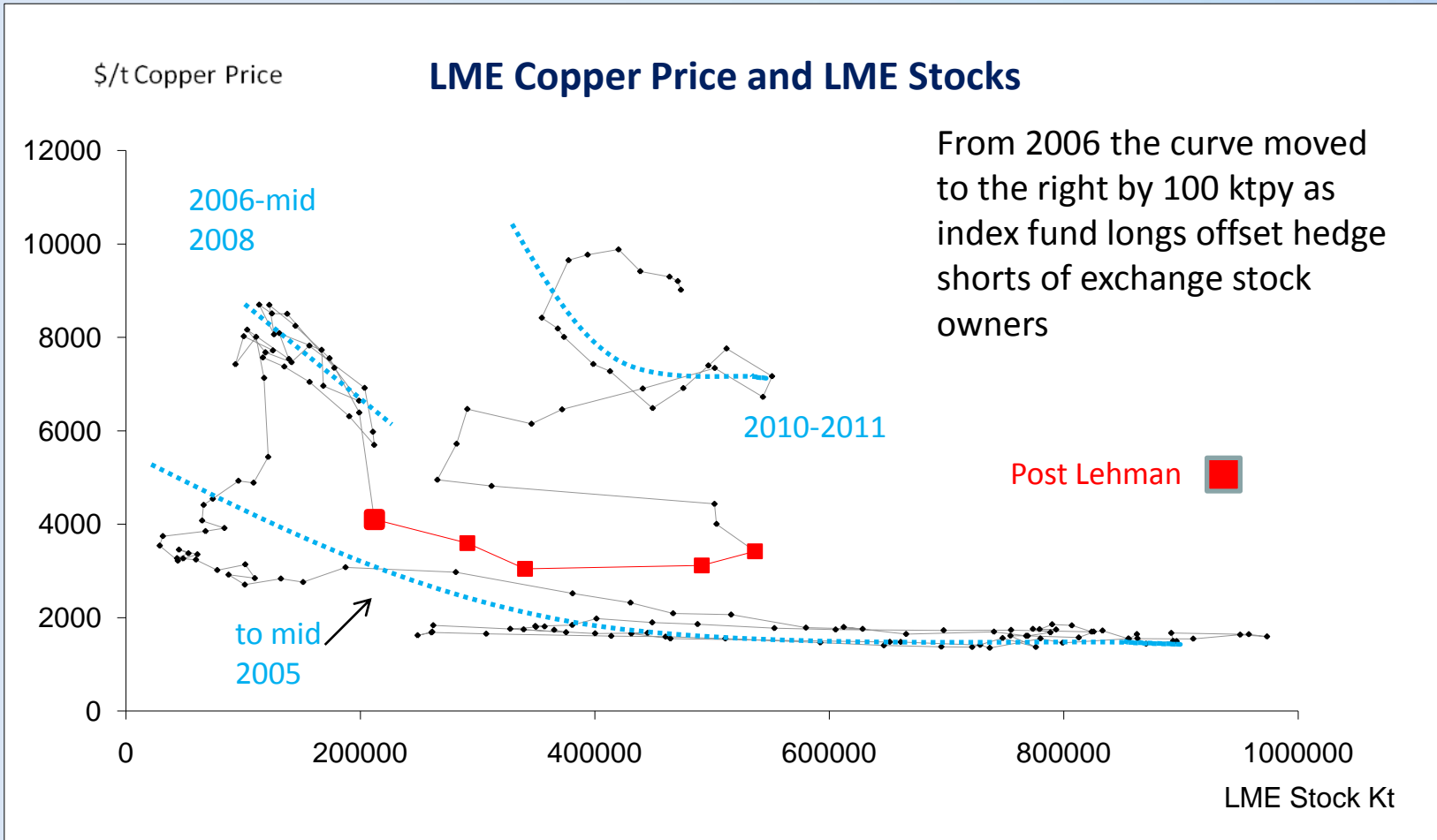


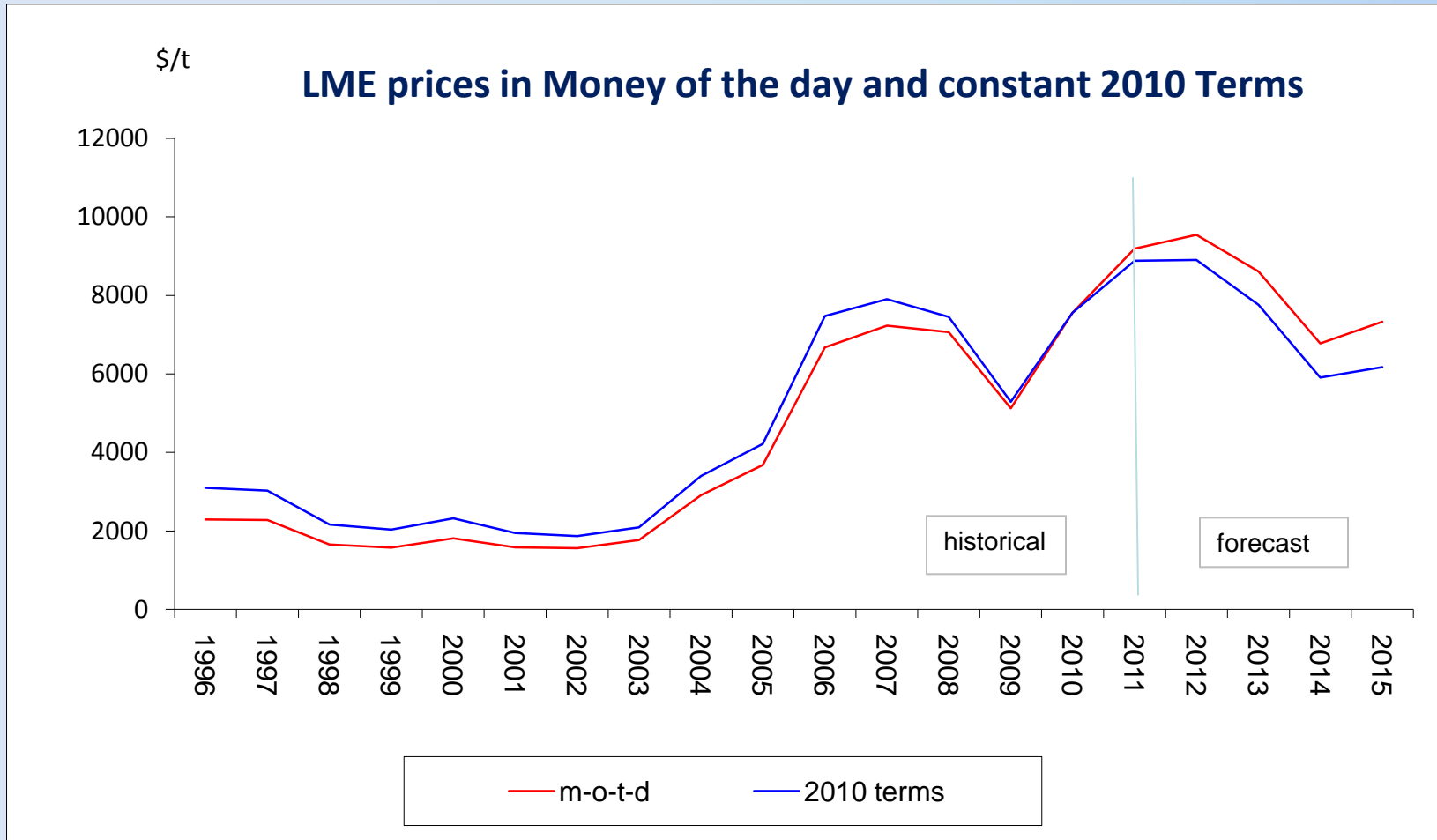
Price Required to Stimulate Just Sufficient Copper Exploration (1)

- **Cost of adding copper reserves averages US\$50/t or 2.25c/lb (HanOcci)**
- **Historically where high prices were only seen at cyclical extremes, it would take US\$7500 - US\$8500/t or \$3.40 – \$3.60/lb to stimulate the US\$2.0B to US\$2.5B of annual copper exploration required to sustain 2.5% - 3.0% p.a. production growth (HanOcci)**

Price Required to Stimulate Just Sufficient Copper Exploration (2)

- **However previous cyclical extremes caused inflated drilling costs and high ratios of green-field to brown-field exploration, thus reducing results per dollar spent (HanOcci/BME)**
- **Tentatively, if higher prices were sustained rather than just cyclical extremes, more drills may become available, thus lowering costs and there would also be a higher brown-fields to green-fields ratio. A tentative long term sustainable price sufficient to support 2.5% - 3.0% p.a. mine production growth might be \$5500 –\$6000/t or \$2.50 - \$2.70/lb (BME)**





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